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Agriculture

Volume LXIV Number 3 June 1957

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Myxomatosis and the Fox

R. A. LEVER, C. J. ARMOUR and HARRY V. THOMPSON

Ministry of Agriculture, Fisheries and Food, Tolworth, Surrey

How far has the diminished population of the rabbit affected the diet of the fox? The full answer is not yet known, but the following article, based on a study of the situation by the Ministry's Infestation Control Division, shows the kind of food that is now attracting foxes.*

LET no one fear that foxes are becoming infected by myxomatosis; the results of sixty years research, and careful observations of the outbreaks of the disease in Australia and Europe, have shown that only European rabbits—and very rarely the brown and mountain hares—are affected.

When rabbits became almost a rarity in many parts of Britain in 1954–55, there were quite reasonable fears that foxes might turn more and more to eating farm stock. Very little is known about the food habits of predatory birds and mammals in Britain, and it is fairly widely believed that a particular predator is largely dependent on a single prey species. This is not the case, and work in this country has confirmed studies in other parts of the world which show that although predatory animals have their food preferences, they tend, within certain limits, to eat whatever is most readily available. But it could still be said that the virtual, if temporary, disappearance of the rabbit occurred so rapidly that there was little alternative wild prey for the fox, and that the most readily available food might be poultry and sheep. But, in fact, foxes did not ravage the countryside, although damage to stock did increase in some areas. Foxes have certainly turned to other wild foods to replace the rabbit, but if attacks on stock are to be prevented there can be no relaxation of fox control measures.

To find out what foxes have been eating, stomachs and intestines have been examined in the laboratory, and information on predation and control during the six month periods immediately before and after myxomatosis has been collected by means of a questionnaire sent to all county pests officers. In addition, visits have been made to selected districts and discussions held with members of the agricultural community.

The diet of the fox

It is no easy matter to study the food habits of a predatory mammal, and very little work has been done on the biology of the fox in Britain. In 1939 two Oxford zoologists, Southern and Watson[1], examined 51 stomachs and 18 faecal pellets of foxes and found that the chief food items were rabbits (55 per cent) and sheep (19 per cent), followed by small birds and insects; the material was collected during the summer. Just after the war a short paper by Hurrell[2] listed the diet of foxes in Devon as rabbit (60 per cent),

* Earlier articles dealing with myxomatosis were published in the October 1954 and May 1956 issues of *Agriculture*.

beetles (16 per cent), sheep (8 per cent), mice (6 per cent), miscellaneous (10 per cent).

Our own studies began in January 1955, and we decided to examine stomach and intestinal contents rather than droppings, partly because food *in* the fox is less digested and more readily identifiable, and also because we wished to make measurements of foxes and collect material for studies of reproduction and parasites. At the time of writing, more than 300 fox bodies have been obtained, but the digestive tracts of many of these are still in preservative, awaiting examination. The identification of the contents cannot be done hurriedly, and frequently involves making cross-sections of hairs or taking plastic impressions of their cuticular scales. The method adopted for recording the stomach and other contents is that of the frequency of occurrence of any particular item. This qualitative system is followed by workers in the U.S.A. and seems less subject to error than any quantitative method entailing scoring systems or volumetric measurements.

By the spring of 1955, myxomatosis had spread to most of southern England and Wales, and to many places in the north and in Scotland. Attempts were made to obtain foxes from disease-free but rabbit-infested areas so that a comparison could be made between the foxes' food before and after myxomatosis. In fact, only ten foxes were obtained from areas free from myxomatosis, but a comparison between them and an equal number from the same counties taken twelve months later shows (Table 1) that whereas rabbit was present in five out of ten foxes before myxomatosis, it had dropped to one out of ten afterwards. At the same time, the occurrence of voles had risen from one out of ten to four out of ten. The high figures for sheep in this table are due to the majority of the foxes having come from the Scottish Highlands and Westmorland; Southern and Watson[1] also found that sheep are more prominent in the diet of upland foxes.

Our sample of foxes throughout the country is certainly not a random one, since the animals we receive are often killed because of reports of lamb-worrying or poultry-killing, and our figures will thus tend to exaggerate the importance of these items in the diet of the fox population as a whole.

Table 2 on p. 109 shows the food content of 80 foxes, all collected from areas to which myxomatosis had spread. It will be seen that they were still eating some rabbits, but that voles had become a very important food indeed and that sheep (some of it carrion), wood mice, brown rats, poultry, small birds and beetles were all taken fairly frequently. Lockie[3], working in Scotland, also noticed an increased consumption of voles and mice immediately after the spread of the disease, although occurrences of rabbit and hare went up again subsequently. His findings were based upon an examination of 98 fox droppings and 14 stomachs, 26 of the samples examined being collected before myxomatosis.

The high position in the diet now taken by voles, chiefly the field vole (*Microtus agrestis*) has already been remarked upon. Hair examination, confirmed by the presence of cheek teeth, shows that this is the vole most frequently eaten, but some bank voles are also taken. It is interesting to have confirmation of the general belief that foxes prefer voles to wood mice (*Apodemus* spp.) From the evidence of skeletal remains, the brown rats taken were mainly young ones. Foxes would rarely be able to catch adult grey squirrels, but they do take them from traps and eat those that have

TABLE 1 *Items of Fox Diet*

TABLE 1 *Items of Fox Diet*

BEFORE MYXOMATOSIS (10 foxes examined)										
Locality	Date	Rabbit/Hare	Vole	Sheep	Roe deer	Small birds	Beetles	Grass	Empty stomach
	1955								
ARGYLL:									
Kingairloch, Barguillean, Taynuilt, Barcaldine	May	+		+		+	+	+	
WESTMORLAND:									
Kentmere	Mar.			+					
Selside				+			+	+	+
Troutbeck	May			+					
Bannisdale		+			+	+		+	
DERBY:									
Kirk Ireton	Mar.	+	+			+		+	
Peak Forest		+		+				+	
CHESHIRE:									
Dunham Hill		+						+	
		5	1	6	1	3	2	8	1
Frequency of occurrence of food items		Rabbit/Hare 50%; Voles 10%; Sheep 60%.							

AFTER MYXOMATOSIS (10 foxes examined)															
Locality	Date	Rabbit/Hare	Vole	Wood mouse	Brown rat	Sheep	Dog	Small birds	Poultry	Beetles	Other insects	Grass	Leaves & twigs	Empty stomach
	1956													
ARGYLL:														
Loche Awe	Apr.		+											+
S. Lorn	May		+			+				+		+	+	
S. Oban						+						+		
WESTMORLAND:														
Selside	Apr.	+										+		
Shapfell			+	+		+	+							
Swindale	May					+								
Little Mosedale			+	+		+		+				+		
DERBY:														
Calver	Feb.				+							+		+
Brassington	July										+	+		
CHESHIRE:														
Mollington	Apr.								+			+		
		1	4	2	1	5	1	1	1	1	1	7	1	2
		Rabbit/Hare 10%; Voles 40%; Sheep 50%.												

been shot. It is notable that rabbits and hares still figure substantially on the menu of foxes, and it is unfortunate that the differences in the hairs of these two mammals are not usually precise enough for separation, particularly as there has been some evidence of an increase in the number of hares after myxomatosis.

The amount of lamb-killing as distinct from lamb-eating is a perennial problem, because it is always difficult to know how many dead, stillborn or weak lambs are represented in the fox diet. Such factors as the coincidence of late lambing and the arrival of cubs, the abundance of foxes in the area concerned and the condition of ewes after a severe winter have all to be considered. Knowledge of local conditions can correct false assumptions—for example, stained wool cut from the crutch of sheep and thrown under hedges is readily eaten by foxes, and the presence of wool in a fox stomach is only circumstantial evidence.

It is difficult to identify the remains of birds in fox stomachs, since the recognizable wing primaries and tail feathers are not eaten and usually only quill bases, with perhaps breast or back feathers and feet, are present.

The insects that we found present most often were various species of dor beetles (*Geotrupes* spp.) which are frequently found in manure and usually appear in fox stomachs in the summer and autumn; next in frequency were ground beetles (*Carabidae*). Wing-cases, legs and abdomen are the usual remains, and heads are rarely seen. Other contents included the larvae of the hover fly (*Myiatropa florea*), caterpillars of the dark arches moth (*Apamea monoglypha*) and larval blowflies (*Calliphora erythrocephala*), the last suggestive of carrion.

Blades of grass and, more rarely, stems were generally found, but some of these may have been derived from herbivorous prey. Small amounts of leaves, twigs, bark, moss and bracken also occur. Seeds of oats and wheat may have come from birds, but the stones of wild plums, blackberries and apple pips (Flintshire, Kent and Cornwall) were certainly autumn fruits swallowed by the fox. There is no doubt that, as in the U.S.A., vegetable matter can form an appreciable part of fox food at some seasons of the year. In three instances (two from Fife and one from Cornwall) portions of colourless egg membrane were found; it is interesting that there were no fragments of egg-shell. No fewer than 23 out of 80 fox stomachs were either almost or quite empty; those from hilly areas contained much more food (up to 4½ oz dry weight) than the lowland ones (less than 1 oz).

Predation

Throughout the country, there has always been considerable disagreement about the extent to which foxes prey on livestock, and obviously it varies with local conditions and from one area to another. The fox provokes endless controversy. It has the teeth and digestive tract of a carnivore, yet it can digest starch in quantities of up to half the dry weight of its food. It can live mainly on rabbits, or carrion, or exist in places where neither abounds. To the huntsman it is the well-loved quarry and to some poultry-keepers and sheep-farmers a wanton killer. Although many farmers follow hounds, and some are Masters, the conflict of interests is not easily resolved. But too many foxes are as bad for hunting as too few and, in hunting country, the

TABLE 2 *Items of Fox Diet—after Myxomatosis* (80 *foxes*, 10 *from each of* 8 *acres*)

TABLE 2 *Items of Fox Diet—after Myxomatosis* (80 *foxes*, 10 *from each of* 8 *acres*)

LOCALITY	DATE	Rabbit/Hare	Hare	Voles (Field & Bank)	Water vole	Wood mouse	Brown rat	Grey squirrel	Hedgehog	Sheep	Fallow deer	Roe deer	Pig	Dog	Small birds	Poultry	Pheasant	Pigeon	Gull	Moor-hen	Beetles	Other insects	Slugs	Grass	Leaves & twigs	Grain	Fruit	Empty stomachs
SCOTLAND																												
(1) Aberdeen, Argyll, Fife	Apr. 1955/ Nov. 1956	3		4		3	2			4					4						3			6	5			2
ENGLAND																												
(2) Westmorland ..	July 1955/ Dec. 1956	4		4		1				5		1		2	1	2					3			3	2			2
(3) Cheshire, Derby, Lincs, Northants, Notts, Glos	Mar. 1955/ Jan. 1957/	3		4		2	2			1	1				1	1	1				1	1		6	1	1		3
(4) Essex	Apr. 1955/ Feb. 1957	4		3	1	2	1						1		7						1		2	7	2		1	5
(5) Kent	Aug./Nov. 1956	3		3		2	3	1		1			1		1	3	1				3			6	3	2	2	4
(6) Hants, Sussex.. ..	Mar. 1955/ Feb. 1957	1	3	2		3	2	1								5	1	1						5	3		2	2
(7) Cornwall, Somerset ..	Apr. 1955/ Jan. 1957	2		4		2			1	3						2			2		6	2		8	2	1	2	3
WALES																												
(8) Flint, Montgomery, Pembroke, Denbigh	Nov. 1956/ Jan. 1957	1		5		1	1			1					4	1				1				4	2		3	2
Total occurrence of food items (80 *foxes*)		21	3	29	1	16	11	2	1	15	1	1	2	2	18	14	3	1	2	1	17	3	2	45	20	4	10	23
Percentage occurrence ..		26½	3¾	36¼	1¼	20	13¾	2½	1¼	18¾	1¼	1¼	2½	2½	22½	17½	3¾	1¼	2½	1¼	21¼	3¾	2½	55¼	25	5	12½	28¾

best compromise is reached when there is full co-operation between the hunts and others concerned with fox control.

In only five counties in England and one in Wales was killing of sheep or lambs by foxes considered to have increased immediately after myxomatosis, while one county in England reported a decrease. There is no doubt that dogs are responsible for some of the sheep-killing attributed to foxes, and it is worth remembering that foxes are relatively small; a male fox weighs only about 15 lb and a vixen is some 3 lb lighter.

Sixteen counties in England and one in Wales reported some increase in the numbers of poultry taken by foxes after myxomatosis; one county reported a decrease. Poultry on free range are a temptation to a hungry fox, particularly if the bodies of birds dying from disease are not disposed of, but there were many instances of marauding foxes breaking into pens in daylight and even entering farm buildings and carrying off pullets.

Most gamekeepers agreed that predation increased during the rearing season after myxomatosis, and it was thought advisable to make greater use of lamps at night, and maintain 24-hour patrols around the breeding fields. Fourteen counties in England and one in Wales reported increased killing of game, and four counties reported a decrease.

Undoubtedly one of the most satisfactory ways of assessing the food of the fox is to make a biological study of foxes on a reserve, as was done by Scott and Klimstra[4] in the U.S.A. They collected droppings, mapped fox movements, examined the remains of food at earths, and estimated the influence of the foxes on the populations of the animals they were eating. Their results cannot be summarized adequately here, but they found that foxes ate mammals, birds, invertebrates and plant food throughout the year and that although mammals formed the staple diet, insects and fruits were taken seasonally in large quantities. Seasonal changes of diet, according to the abundance of various foods, has the effect of relieving the pressure on some prey species, and may allow their populations to recover. In places where rabbits are very scarce, it is thus unlikely that foxes will be of any material assistance in rabbit control.

Fox control

The immediate effect of all the apprehension about increased fox predation after myxomatosis was to stimulate measures for fox destruction, as was shown by the answers to the questionnaires. While the number of foxes killed by the hunts increased slightly, the number killed by other methods such as shooting, trapping and gassing, increased very appreciably.

Many new fox-destruction societies have been formed since myxomatosis. During 1956, 134 societies in Wales and 53 in England accounted for 7,273 foxes. In addition, 5,523 foxes were killed in State forests and, during 1955–56, thirty-three societies in Scotland destroyed 10,956. When allowance is made for foxes killed by the hunts and other means, the annual total of foxes taken by all methods may be as high as 40,000.

It is interesting to note that there was a very marked increase in fox destruction in Queensland, immediately after myxomatosis had swept across Australia[5]. The Queensland authorities paid a bounty of 5*s.* for a fox scalp, and the number of foxes killed rose from 14,342 before myxomatosis to

35,717 in 1951–52, and fell to 16,469 in the following year. There were certainly some reports of severe losses of sheep due to foxes, but it seems probable that much of this fox destruction was a precautionary measure.

Finally, a word on bounty systems. They are generally viewed with some scepticism by biologists, for a bounty tends to create a vested interest in the animal concerned. A pest should be destroyed because of the damage it does and not for the artificial value of its scalp or tail. But there seems to be no doubt that the well-run fox-destruction society, receiving contributions to its funds both from farmers and the State, and organized in conjunction with county pests departments, can be the most effective method of fox control in areas where the use of hounds or other means of control are difficult or impossible.

It is clear that the fox is very adaptable, both in its behaviour and feeding habits, and despite energetic measures for its destruction there is not the least likelihood of its being exterminated.

We are grateful to all those who have sent us foxes and given information and help in our enquiries, and hope that they will wait patiently for the full results.

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★ *NEXT MONTH* ★

spotlights

Norfolk Farming
(including the Royal Estate at Sandringham)

The Country Landowners' Association
(*by Earl of Bradford*)

Centenary of the Great Yorkshire Show
(*by Sydney Moorhouse*)

The Economic Structure of Welsh Farming

E. A. ATTWOOD, M.A.
Department of Agricultural Economics, University College of Wales

New and better methods are changing the face of agriculture in Wales, but they have in no wise diminished the proud traditions of family farming.

THE emergence of Welsh farming from a traditional into a progressive industry has been a relatively recent development. The present economic structure of the industry represents only the most recent stage in this development, and the future will almost certainly bring further changes. An analysis of the present position is, however, an essential basis from which any discussion on the future of farming in Wales must start.

In Wales there are just over 2·6 million acres of agricultural land, excluding rough grazing, divided between 32,000 agricultural holdings of 20 acres and over, which constitute farms for the purpose of this article. The average size of a full-time farm is just over 80 acres; like many averages, this is very inadequate as giving a useful picture of the Welsh farm unit, for it covers a diverse farming pattern. The following diagram shows the breakdown, according to the size and type, of the 32,000 farms[1].

Welsh farms of over 20 Acres
(total 32,000)

	Better land farms (20,800)			Poor land farms (livestock-rearing) (11,200)		
	Dairy	Mixed	Livestock rearing	Selling milk	Not selling milk	Total
Under 100 acres ...	10,100	2,100	4,500	4,500	3,600	24,800
Over 100 acres ...	1,100	1,100	1,900	1,900	1,200	7,200
	11,200	3,200	6,400	6,400	4,800	32,000

The criteria adopted for deciding the type of farm are the quality of the land and the relative importance of milk in the total farm output. The boundaries between the different groups of farms are, inevitably, arbitrary, for farming does not sort itself into a neat and easily defined collection of farms.

Almost two-thirds of Welsh farms are engaged in commercial milk production, the growth of which since the early 1930s has been the outstanding feature of the recent development of Welsh farming. Over four-fifths of these milk-producing farms are under 100 acres; the "typical" Welsh holding is the small dairy farm, worked almost entirely by the farmer and his family. Most of these farms are on the better land which is found on the coastal fringe and in the valleys; the extension of dairying into the hill areas has

been limited by physical factors, and also by the refusal, in the past, to allow capital grants for upland farms to be used to develop dairying enterprises.

The remaining one-third of Welsh farms are devoted mainly to livestock rearing, producing store cattle and sheep. The hill farms have perhaps gained least in the growth of prosperity of farming over the past twenty years. An area with farms of this type was the subject recently of a special investigation by the Welsh Agricultural Land Sub-Commission, whose Report has given rise to a deep controversy that has emphasized the problem of these farms and the great difficulty of finding a solution satisfactory to all the farmers concerned.

Livestock production and products pay best

The climate and physical features of the country are such that the production of cash crops is not a profitable undertaking. Early potatoes grown in Pembrokeshire, plus a small acreage of seed potatoes and other seed crops, are the only notable sources of income from cash cropping. Of the (approximately) 4 million acres devoted to agricultural use, rough grazing accounts for 1·4 million acres, and permanent grass for 1·7 million acres. Only one-tenth of the total area of farming land is under arable crops, most of which are grown for livestock feed. There are over 200,000 acres of oats and mixed corn, and nearly 80,000 acres of rape, cabbage and kale. This leaves just over 100,000 acres for all other crops and, apart from potatoes and roots for stock-feeding, none of them is of any great significance in the economy of Welsh agriculture.

This 4 million acres is almost exclusively devoted to the production of livestock and livestock products; it supports over 1 million cattle and 4½ million sheep. The cattle population has changed greatly in its composition: with an increased number of the pure dairy breeds, less dual-purpose cattle were required. Though the general production of store and fat animals has declined, it remains pre-eminent in the mountain areas, for the store animals produced are the raw material of the lowland fattening farms.

Pigs and poultry are found on most Welsh farms as supplementary enterprises to dairying or livestock rearing. The generally low standard of farm buildings has hindered the development of intensive pig and poultry production, even though such undertakings would fit in very well with the economy of the small family farm.

In spite of the preponderance of small dairy and livestock farms, Welsh farming is very highly mechanized. There are more than 38,000 tractors (for 32,000 holdings!), 30,000 ploughs, and the usual range of cultivating machinery. Most farms have hay harvesting equipment, including a mower, side-rake and hayrake; the binder is generally considered to be of less importance and, although there are over 12,000 of them, many are old machines used only on small acreages. Most of the 7,000 potato spinners and elevator diggers are also used only on small acreages, except in the early potato-growing areas. Mechanization has become a great asset round the farmstead, as is proved by the use of 14,000 grinding mills and 12,000 milking machines on 20,000 milk-producing farms. The farmer and farm worker have therefore considerable mechanical power at their command, and this, no doubt, will be developed as equipment especially suitable for small farms becomes available.

The following table shows the average levels of production and income on farms on the better type of land[a].

Farms on the better type of land

Size group (*acres*)	Dairy				Mixed			Livestock-rearing		
	Under 50	50-100	100-200	Over 200	Under 100	100-200	Over 200	Under 100	100-200	Over 200
Average size of farm (*acres*)	37	71	134	300	65	139	272	69	149	351
Production per farm (£)	2,329	3,023	5,271	7,748	2,328	3,957	6,971	1,613	2,305	4,776
Farm income per farm (£)	425	466	859	1,276	528	941	1,032	382	489	957
Enterprise profit per farm (£)	28	55	427	868	109	500	652	—45	70	583
Labour units per farm	1·7	2·2	3·4	4·8	2·1	3·3	5·0	1·8	2·6	4·5

It will be seen that on the small farms (under 100 acres) the average net income ranged from just under £400 to just over £500, according to the type of farming. The livestock-rearing farms made the least profit and the mixed farms the most. The net farm income is the profit which the farmer and his wife obtain from the holding; it covers the reward for their manual labour and the management of the farm, and interest on invested capital. If a charge is deducted from the manual labour of the farmer and his wife, the resulting "enterprise profit" is negative for the livestock-rearing farms and very small for the dairy farms.

These figures do, however, conceal wide variations in the output and profitability of the farms within each group. In the under 50-acre dairy farm group, the five best farms had an average annual income of £850, representing £26 per acre more than the five worst farms, where the average loss (before allowing for the value of the labour of the farmer and wife) was £67 per farm. In the 50–100-acre size group, the differences were even greater—the income of the five best farms was over £1,500, or £28 per acre more than on the five worst farms, which incurred an average loss of £374. These ranges of income and output per farm emphasize the great diversity of the financial results of farming in Wales. Although these differences are partly due to the varying qualities of the soil and the physical features of the farms, they are much more a reflection of the differences in the managerial abilities of the farmers concerned. The best run farms had a much higher output per man per acre than the average, and consequently earned two to three times the average level of farm income for the particular type of farm.

All the better land farms over 100 acres had an income of over £800, except for the livestock-rearing farms between 100 and 200 acres. The much higher total production from these farms enabled the farmers to earn incomes considerably above those of the small farmers. These larger farms did not show the same kind of variation in profitability or output per acre as the small farms. They were in many ways much more uniform in their basic organization, and the higher profitability of the best farms came from subtle

differences in the level of management. Generally speaking, on all the better land farms the highest incomes were made on those holdings operating a number of different enterprises—for instance, the most profitable dairy farms usually also ran pigs, poultry and sheep.

Poor land farms

It is on the poor land holdings, which are without the same possibilities for intensification of production, that the farm management problem of achieving a reasonable income for the farmer is more difficult. These farms are very much the "poor relation" of British farming today.

Farms on poor land

Size group (*acres*)	Livestock-rearing							
	Selling milk				Not selling milk			
	Under 100	100-200	200-500	Over 500	Under 100	100-200	200-500	Over 500
Average size of farm (*acres*)	63	145	313	747	60	158	337	1,075
Production per farm (£)	1,099	1,573	2,196	2,216	586	1,189	1,998	2,803
Farm income per farm (£)	90	135	437	456	94	247	499	686
Enterprise profit per farm (£)	—311	—277	39	70	—316	—146	130	251
Labour units per farm	1·9	2·3	2·5	2·2	1·4	2·0	2·5	3·0

In spite of the special grants available, the average income from the under 200-acre farms of this type was distinctly less than the value of the labour of the farmer and his wife. This was as true of those upland farms which had dairy enterprises as those which did not. The basic problem is the low level of total production achieved on these farms. The average production per farm of the non-milk selling group of under 100 acres was £586; with total expenses amounting to £492, less than £2 a week remained for the farmer. The milk-selling farms of the same acreage had a higher production, but no better incomes.

Only the poor land farms over 200 acres gave the farmer an average income at least as good as the value of his labour. These farms had a production of between £2,000 and £3,000, which is about the same level of total output as the small better land farms. These larger poor land farms have many of the same basic problems as the small dairy and mixed farms of the lowlands—poor buildings, shortage of capital and relatively high overhead costs.

At least two-thirds of the total poor land farms are under 200 acres, and they represent a great problem in Welsh agriculture. The Welsh Land Sub-Commission suggested resolving the problem by amalgamating holdings, and

this has been taking place slowly under the stimulus of economic forces. For the very small upland holding, most farm economists would agree that, without an extremely high level of Government support, there seems no way in which the average income could be raised to the desirable level (that is, at least four or five times the present level). The problem is, of course, much more than a purely economic one; nevertheless many of the proposed solutions are far too vague about the levels of income likely to be achieved by the farmers concerned. The satisfactory answer will have to give the farmer the possibility of achieving a sufficiently high level of output to enable him to make an adequate living.

Although this analysis has been in terms of broad groups of farms according to the type of farming and the acreage of the farm, the industry consists of thousands of individual units, and not one is entirely like any other. A complete picture of modern Welsh farming would take many volumes: a bird's-eye view of the scene is bound to be limited in scope and in the detail it can reveal. Nevertheless, the overall impression is of an industry making rapid progress under difficult conditions. The tradition of family farming is as strong as ever, and likely to remain so in the foreseeable future.

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To Point of Lay

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Dr. Coles considers the effect of juvenile mortality on profitability and the need to relate rearing method to the system to be adopted in adult management.

MANY poultrymen, in reckoning the return from their laying flock, work on the basis of the laying year and, at about this time, begin to take account of the cost of the food delivered to the laying houses and the weekly sum received for eggs. In arriving at the profitability of the venture, the cost of the pullet at the time of housing is set down at a certain charge, and the income derived from the carcass of the bird at the end of her laying year—or before, if culled—added to income. It must be admitted that few farmers record their rearing costs accurately, and usually charge in a figure varying from about 15*s.* to 20*s.* for the point-of-lay pullet. One of the difficulties about recording accurately and in any detail is that successive batches of chicken are frequently obtained at day-old stage and it is not easy to keep

the detailed costs separately in terms of food, labour, etc., for each batch over a period.

This widespread lack of recording during the rearing period may often mask unduly high costs incurred by some poultry farmers in bringing their birds to point of lay. Furthermore, it does not seem to be generally realized that minor setbacks and false economies during this all-important period in the early life of the layer are often emphasized during the productive life of the bird. For example, the average price of the day-old pullet chick is about 3*s*. Yet a considerable number of poultrymen are unwilling to pay a few pence more for highly reputable chicks, and are often only too anxious to buy chicks from a dubious source because they are a few pence cheaper. In either case the additional expenditure, or the apparent saving, barely equals the price of one egg. But superior stock, producing twenty or more eggs per year than poorer class birds under the same management, brings in another 7*s*. per bird per year when the very slightly higher rate of food consumption is deducted.

Juvenile mortality saps profits

Mortality during the rearing period is another variable factor exerting a great influence on later profit. A number of surveys indicate that the average mortality during the first five months of rearing is 11 per cent. These same surveys, however, refer to very wide divergencies from this average figure among individual flocks. Instances of 5–6 per cent are indicated as a normal juvenile mortality rate for well-managed flocks, while it is pointed out in several of these surveys that a death rate of up to 30 per cent or more seems to be expected by some poultrymen.

The financial importance of these death rates is not assessed with sufficient gravity. In the case of a 20 per cent juvenile mortality rate, the initial loss to the owner is the cost of 20 day-old chicks, or about £3 per 100 birds. Moreover, since the dead chick is virtually worthless, the cost of the flock must be debited with the value of the food which the dead birds have consumed and such other items as heating and labour. If we assume that the average age of death for this 20 per cent mortality rate is two months, the loss is increased by a further £4 or so. Thus the remaining 80 birds reach point of lay, having as a flock to share the loss incurred by the 20 chicks dying—that is, about 2*s*. per bird. Since it is often customary to cost a flock by dividing all charges incurred by the number of birds housed, it will be appreciated that a high juvenile death rate may very well make the poultry venture unprofitable.

The influence of a juvenile mortality rate above the expected figure has an effect on profits beyond the immediate loss of the chicks. This effect will be felt mainly by the owner of the larger flock, and the specialist. In each case housing, manpower and equipment will have been organized to reach maximum efficiency with a flock of so many birds. If the number actually housed is below the expected number, there is rarely any way of making use of surplus equipment or ensuring that full use is made of the labour which, in theory—but rarely in practice—should be available for other work. In consequence, the costs of the surviving birds are again increased above the anticipated figure.

Rearing methods and adult management

Apart from losses incurred in these two fields, the profitability of the poultry flock can be greatly affected by the method of rearing—by whether or not it is the most efficient for the system operated by the farmer in managing the laying stock. There are today a great number of ways of brooding and rearing chicks. Most of these methods have their good points, and most have some drawbacks which may be of outstanding importance when the management of the adult bird is considered. The point here is that most farmers have a system of housing and management which suits the individual and has worked well. A mental survey of the variety of methods now in force confirms this view, and it would be stupid to assert that one system is better than all others. The system in force at most farms has probably been dictated by the farmer's own personal inclination, his skill, or that of his men with a particular method, by local conditions or individual farm peculiarities. Broadly, the system of housing the adult stock will fall under extensive, or intensive, methods.

The question to be answered is whether we are justified in urging the same conditions for rearing stock which will later be housed and managed under widely different environments. A second and closely associated point is the adjustment of the rearing period for the seasonal production curve which the farmer has in mind. It must be admitted at once that on the first point we have very little precise information on which to base sound conclusions. The majority view is undoubtedly that chicks should be hardened-off and, after the initial brooding period, subjected to a fairly tough existence; such a method promotes good feathering and results in a sound-looking, sturdy bird at point of lay.

"Hard" rearing

If this policy is to be followed, it seems right to adopt a brooding and rearing system which gets the birds on range as soon as possible. This system may be associated with a feeding method in which the extensive supply of grain is an essential part of the regime—the aim presumably being to lengthen the period between day-old and point of lay so that the bird is fully grown before being subject to the stress of egg production. With such a rearing policy, it is generally believed that a bird with a high degree of stamina will do well when housed under range conditions. From experience this seems to be the case. But it is also believed that such a bird, if housed intensively—in batteries or deep litter—will, under the stimulus of "softer" conditions, perform at above average.

What is the evidence to support this widely held opinion? The available information from research centres would not seem to support the theory. Workers in North America have compared the performance levels of pullets reared on range and then housed in quarters which were maintained at an even temperature with those which were subject to the normal weather variations after housing. No differences in the performance of the two lots of birds were recorded. More recently, however, research workers at Edinburgh have demonstrated that chicks reared under constant temperature

conditions laid far better in their pullet year than their sisters housed and reared under normal conditions. The conclusions to be drawn from these investigations seem to be that "hard" conditions during the rearing period exert no improving effect on production performance when the adult birds are housed under "soft" conditions.

Rather it seems that birds do best if reared under those conditions to which they will later be subjected. But it must be agreed that the evidence for this conclusion is limited and the result of further investigations now being carried out on a large scale under field conditions should be of great interest. If those results confirm the research workers' findings, then the opinion that a toughening process is essential for all young stock, irrespective of the adult system of management to be followed, will receive a considerable set-back. Moreover, the toughening process usually involves a higher food consumption per bird—in terms of quantity, but not necessarily in cost—than the rate associated with a "softer" system where the maintenance needs are not so high.

This view of the two conditions under which birds may be reared must be treated with caution. If a "soft" method is to be followed it must be realized that the treatment of the growing birds calls for skill in their management, for unnatural conditions are being adopted and errors like draughts and chilling can have drastic results. Care, too, must be exercised when the birds are finally transferred to range, for they may be more greatly affected by such troubles as coccidiosis than their sisters who have been on the ground at an earlier age.

Long- or short-term rearing policy?

One other point having an important association with rearing practice is now coming to the fore—the stage at which the birds are required to come into lay. A few years ago the price of eggs was highest in November when eggs were scarce. As a consequence, the skilled poultryman bought March-hatched chicks and, by management and especially feeding, held them to a period of about 7 months between hatching and point of lay. By these means he could expect a jump to a high rate of production of large-sized eggs just before November, when the birds were housed and received a laying ration calculated to stimulate egg production.

Today, however, the period of egg scarcity and therefore high prices occurs in the late summer, and birds hatched in March or April are required by the poultryman to come into lay at 5 months old. If he still obtains his day-old chicks in the spring, his problem has to be solved partially by the breeder who must produce early-maturing strains; but by management and feeding during the juvenile stage, he can wholly or partially achieve his aim. Some poultrymen prefer to follow the policy of longer-term rearing and are, in consequence, buying chicks hatched late the previous autumn or in the winter. This involves feeding over a longer rearing period, although the cost of a unit of food under this system should not be so high as that with the short-term method. Nevertheless, assessments of the costs of, and returns from, the two methods do not reveal any significant differences in food costs. Stockmanship appears to be the main key to success with either method, for, with the long-term rearing of early-hatched stock, skill is needed to avoid

a neck moult and a drop in egg production in the late autumn when eggs are most needed. With the short-term system, lack of good stockmanship may lead to many *small* eggs, and so the aim of the poultryman is still not achieved.

It will be clear that no "best" policy for brooding and rearing can be recommended. As already stated, the several systems which the poultryman can follow have their special advantages, and these should be considered in relation to the type of management to be adopted for the adult birds and the standard of stockmanship of the poultryman. Nevertheless, some conditions should be observed which are common to all methods, and failure to observe them may result in the period to point of lay involving above-average costs and threatening the profitability of the poultry unit. Among the chief of these conditions is the need to reduce juvenile mortality and ensure that the food used is of the type to suit the system of rearing—not over-costly for a long-term system and sufficiently concentrated for the short-term period. False economies in the purchase of the chick and waste of food should be eliminated. Finally, such obvious rules of good husbandry as ensuring that there is no failure of heat during brooding, nor in the supply of drinking water, the avoidance of overcrowding and chilling, should, of course, be followed. Attention to these several matters may lead to the reduction in the cost of the point-of-lay bird by several shillings and greatly increase the income from the bird when housed.

A Novel System of Intensive Poultry-keeping

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A system of crates each holding twelve birds is the basis of Mr. S. Austin's intensive poultry-keeping at Wollaston, Northants.

MR. AUSTIN has always kept poultry. In fact, his first hen and sitting of eggs were presented to him on his fifth birthday. He is now over sixty. For all these years he has kept poultry on an intensive system, his present enterprise being based on the use of single-tier wooden crates. These are 6 feet×3 feet, with slatted floors, a nest-box at one end, a water trough at the other, and a feeding trough along one side; each crate holds from twelve to fifteen birds. Mr. Austin specializes in the heavier breeds—nervous or sensitive birds are not suitable—and the birds must be debeaked.

The houses are made of wood, with asbestos roofs 32 feet×16 feet, and are erected on concrete bases. The height to the eaves is 5 feet 9 inches and to the ridge 8 feet. On the deep litter system, allowing 4 square feet per bird, houses of this size will accommodate 130 birds; on the Austin system, with ten crates each holding twelve birds, the total is 120, but another crate could

be included in place of the food bin, or fifteen birds could be kept in each crate.

The houses are draught-proof but have no special insulation. The only parts covered are those immediately over the roof trusses, where it is necessary to prevent moisture getting into the joints. Ventilation is through an open ridge, and even after heavy rain there is no sign of water getting in. Fine-mesh wire netting, which is fixed along the opening to keep sparrows out, also serves to hold any drifting snow. At each end of the houses there is a wide sliding door which can be left open during warm weather to allow a free draught of air, but wire-covered doors, hinged on the inside of the building, are also necessary to keep out the sparrows.

Easy handling and low costs

The system provides an easy means of handling the birds for debeaking and other purposes. A plywood division board slipped into the centre of a crate enables the birds to be concentrated at one end, and the movable top can readily be replaced by a crate top which allows free access. With the birds in small groups it is easy to see if any are "off colour" or if there are any other problems. The birds are evenly distributed over the floor space, they are healthy, well feathered and good layers, and so far there have been no difficulties. There is no unpleasant smell; the air is dry and the walls and roofs of the houses are free from condensation.

Little labour is required and the building can be much cheaper than that needed for batteries.

Nest-boxes are made so that one structure serves two crates: a division in the centre prevents the birds from mixing. Each nest is 2 feet long by 1½ feet wide and is fitted with a sloping, flattened, expanded metal floor, so that eggs roll away from the nest and so can be easily counted and collected. Some of the birds sleep in the nests, but it is of no consequence because the droppings fall through the wire floor. Thus only a few eggs are soiled, and these can quickly be wiped clean.

Home-mixed mash is fed on the basis of twice-a-week-feeding, and a supply of meal is kept in a bin in each house for topping-up between times. At present, water is replaced twice weekly, but it would be relatively simple to provide automatic watering.

The droppings which fall through the slats can be removed easily by a long-handled, light shovel. It is necessary to do this only once or twice a year, when convenient. Hydrated lime is spread on the soil below the crates and more added to the droppings at intervals during the season.

A system of crates lends itself to easy adaptation. For instance, at first the slats appear to be closer together than is really necessary, but this is to allow for alternative uses for the crates which can accommodate table poultry just as easily as month-old birds: in fact, some of the layers on the farm were actually reared from eight weeks to maturity in these same crates.

Although, as Mr. Austin is the first to admit, considerable development can still be made, his enterprise offers many of the advantages of deep litter and battery cage systems and at the same time avoids many of their disadvantages. It may well be the next stage in the progress of intensive systems of poultry management.

The Planning of Cherry Orchards

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Time, effort and money can be saved by planning orchard planting in the light of ripening sequence.

OF all the fruits grown commercially in Britain, the sweet cherry undoubtedly poses the most difficult problem in orchard planning. There are a number of factors which make the planning of an individual cherry orchard a difficult and complicated task. The cherry is a perishable fruit and each variety must be picked quickly, as soon as it is ready. Usually, each tree is cleared in one operation, although with some varieties (particularly the early ones) it is worth while picking-over, taking the ripest, and clearing the remainder a few days later.

No variety of sweet cherry is self-fertile and, to obtain fruit, each needs a pollinating variety flowering at the same time, growing nearby. It is even more complicated than that—varieties of sweet cherries can be classified in twelve groups and, while the varieties in one of these groups (the Universal Donor group) will pollinate any other variety in any group which flowers at the same time, in the other eleven groups varieties within a group will not pollinate each other. It should be mentioned, however, that new incompatibility groups are discovered from time to time.

Planting in seasonal sequence

The organization of picking is usually based on a gang of 8–10 pickers; they work under the direction of a "ganger" who is also the ladder-mover, and will have twelve or more ladders for his workers. Moving and placing ladders is a very skilled job, especially when tall trees are being picked, and time and effort can be saved if rows of varieties are planted in the order in which they ripen; that is, with the earliest ripening variety on one side of the orchard and the others following in seasonal sequence.

Set plans for cherry orchards have been suggested from time to time, and two of these are included in the Ministry's Bulletin No. 119 *Plums and Cherries*,* but for satisfactory planning much more information is required. For instance, for each variety it is necessary to know the incompatibility group, the flowering period in relation to other varieties, and the sequence of ripening and picking. In the past, some fruit growers tried to include another factor—the size of the tree. It was assumed that space and land would be better utilized if a vigorous or tall variety were planted next to a short one, or to a smaller-headed variety. While this may be a point worth considering, the other factors already mentioned are much more important and the problems are difficult enough without adding to them. The table opposite shows incompatibility and flowering groups.

* Obtainable from H.M. Stationery Office, price 2*s.* 6*d.* (2*s.* 8*d.* by post).

Flowering and Incompatibility Groups of Varieties of Sweet Cherry

INCOMPATIBILITY GROUPS	*FLOWERING GROUPS (in order of flowering)* 1	2	3	4	5	6	Not known
Universal Donors	Noir de Guben	Mumford's	Black Oliver Bullock's Heart Merton Glory	Smoky Dun	Bigarreau Gaucher Florence		
I	Early Rivers	Bedford Prolific Circassian	Roundel	Black Downton			
		Knight's Early Black	Tillington Black				
II		Bigarreau de Schrecken Waterloo Merton Favourite	Frogmore Early Merton Bigarreau Merton Bounty		Victoria Black A Black Elton		
III		Bigarreau de Mezel (1)		Emperor Francis Napoleon Bigarreau Ohio Beauty			
IV			Merton Premier	Kent Bigarreau	West Midlands Bigarreau		
V		Turkey Heart					
VI		Merton Heart	Early Amber Governor Wood Elton Heart				
VII			Bigarreau de Mezel (3)		Hooker's Black	Bradbourne Black Geante d'Hedelfingen	
VIII			Peggy Rivers				
XII					Noble Caroon A		
As yet unknown	Nutberry Black					Cooper's Black	Rockport Bigarreau

This table is based on information published by the John Innes Horticultural Station and the East Malling Research Station.

Note: There are few commercially-grown varieties in groups IX, X and XI.

Any variety in one of the flowering groups will flower sufficiently close to any other in the same group, or in the group either directly preceding, or immediately following it; for example, the ideal pollinators for Roundel will be found within the same flowering group (group 3), but it could also be suitably pollinated by any variety in flowering groups 2 or 4, provided the variety chosen is not in the same incompatibility group as Roundel. Thus Merton Heart in flowering group 2, Elton Heart in flowering group 3 or Emperor Francis in flowering group 4 will be found satisfactory.

Ripening order

A list of cherry varieties giving the sequence of picking is essential. The sequence varies from season to season and even from district to district, but differences are usually only small. Sometimes there appears to be quite a large difference in the picking dates of the same variety grown on two different farms or in two different districts. In nearly all such cases it is found that although the same description has been used, the cherries are different varieties and one, or sometimes both, have been wrongly named. Examples of faulty naming of this kind are all too frequent with sweet cherries.

The following list is provided as a guide. In the main it should prove to be accurate, but we haven't yet sufficient information over a wide area to be sure of the correct positions of all varieties, and especially of the newer Merton varieties.

ORDER OF RIPENING

Early

Early Rivers
Mumford's

Early midseason

Bigarreau de Schrecken
Peggy Rivers
Governor Wood
Early Amber
Merton Heart
Circassian
Knight's Early Black
Black Oliver
Bedford Prolific A
Rockport Bigarreau
Frogmore Early

Midseason

Merton Bounty
Merton Glory
Elton Heart
Nutberry Black
Victoria Black A
Merton Favourite
Merton Premier
Waterloo
Roundel
Tillington Black
Caroon A

Late midseason

Kent Bigarreau
Napoleon
Noir De Guben
Bigarreau Gaucher

Late

Cooper's Black
Noble
Florence
Emperor Francis
Merton Bigarreau
Bradbourne Black
Ohio Beauty

From the information given in the table and list, it should be possible for the intending grower to prepare a planting plan for his cherry orchard, or to fit new varieties into an old orchard. The table is not complete; there are still varieties which have to be tested and placed in their appropriate incompatibility groups. Some varieties in the list are not included in the table because flowering times are not known with certainty. No doubt as time goes on more information will be available on these points.

Perhaps a note on the rather special case of Early Rivers should be added. Of the better known commercial varieties, it is the first to bloom, and the ideal pollinating variety to plant near it is Noir de Guben, which ripens much later, but despite this disadvantage, some cherry growers do plant these two varieties together.

Reclamation of the Wieringermeer Polder

G. GRAHAM SAMUEL, M.SC.

The story of the reclamation of the first Zuyder Zee polder, the Wieringermeer polder, is told in a commemorative book, *Wording en opbouw van de Wieringermeer. In the first of two articles, Mr. Samuel discusses the agricultural and sociological aspects of this impressive accomplishment. The second article, which will be published in August, will deal with the colonization of this new land by wild life.**

IN SEPTEMBER 1956 the 56-mile long dykes of the third polder (Eastern Flevoland) to be reclaimed by the Dutch from the old Zuyder Zee were closed after nearly six years' work. The pumps then started have been pumping continuously ever since at the rate of nearly 1 million gallons per minute. About the beginning of July this year another 135,000 acres of land, which for hundreds of years has lain beneath the sea, will become dry land—or rather, wet land—and by 1960 it is expected that this land will be yielding a harvest of over 40,000 tons of grain and other seeds. In less than twelve years from now it will have been laid out in 2,000 farms, with farmhouses, farm buildings, livestock and all kinds of crops; there will be villages with shops, schools, churches and community halls, and the villages will be linked with the mainland and with one another by good roads, planted with long lines of trees. In that short time a thriving new community of some 35,000 people will have been created on land which is still beneath the water today.

How is it that such confident predictions may be made? It is because this is the third big polder to be reclaimed by the Dutch from the Zuyder Zee, so that these estimates are based on practical experience. A little over a year ago some modest ceremonies were held to mark the twenty-five years' existence of the first of the Zuyder Zee polders, the Wieringermeer polder, and the story of its development was then published in a souvenir volume.* This book runs to 800 pages, with about 200 photographs and maps, and an English summary of more than 60 pages. It is a worthy record of one of the most impressive accomplishments of modern times—an accomplishment which every visitor regards with admiration.

Work begun in 1930

The draining of the Wieringermeer polder was begun in 1930, before the 20-mile long main embankment sealed off the opening of the Zuyder Zee. The 50,000 acres in this first polder were thus reclaimed from beneath ordinary sea water. Incidentally, since the building of the main embankment, the waters of the former Zuyder Zee, now the Ijssel Lake, have gradually become fresh from rain and the flowing-in of rivers; in the polders now being built, therefore, cultivation will not have to wait until salt has been leached out of the soil, as it did in the Wieringermeer polder.

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* Published by H. VEENMAN and ZONEN. Wageningen, 1955. 15 *guilders.*

Foreseeing the many problems that would have to be solved in the cultivation of salt-saturated soils, the Dutch first constructed a small trial polder three years before the main polder was due to be drained. Here experiments were carried out on methods of draining, de-salting, choice of crops, manuring, soil microbiology, etc. Of course, these could give only the guiding lines for development, and when the main polder was drained many fields were set aside for further experimental work. Indeed it may be said that experimenting has never ceased and that the success of these huge enterprises is built very largely on the principle of acquiring knowledge by experiment and then applying it.

While the land was still beneath the sea, a quite extensive soil survey was made by means of boring instruments used from boats. This enabled a map to be made showing the nature of the top soil and subsoil over the whole area and the main lines of subdivision for drainage to be planned. In the land destined for farming there were 15,000 acres of clay soil, 16,000 acres of sandy clay and 14,000 acres of sandy soil. The lime content of the soils was also determined, as this was of great importance for future development. Fortunately, relatively little of the land was lime-deficient and special measures were quickly taken to correct the high acidity which developed in these parts after draining.

The main drainage canals (the largest of which were also to be used for shipping) and laterals were dredged while the land was still under water. Immediately the land was dry, main ditches were dug and then a close network of drainage trenches, 2 feet deep. These trenches were from 15 to 30 yards apart on the sandy soils, and as close as 12 yards on the heavier soils. Within two years of the water being pumped out of the polder, nearly 9,000 miles of trenches had been dug, about 80 per cent of them by hand.

Experiments in the trial polder and in the main experimental field had shown that trenches gave better results than tile drains in the early stages of reclamation, though being obstacles to cultivation and encouraging weeds, they had their disadvantages in causing loss of land. As soon as soil conditions permitted, therefore, the open ditches were replaced by tile drains, laid from 2½ to 4 feet below the surface. Also, from an early stage, thousands of soil samples were taken each year to determine the salt content of all sectors of the polder; the results were plotted on special maps, from which areas ready for cultivation could quickly be seen.

It was natural that the salt was washed out first from the lighter soils. Some of the heaviest soils had a consistency like shoe-polish, and formed a network of cracks on drying; it was eight years or more before some of these areas dried out fully and acquired the characters of normal soil.

The very sandy soils at the north end of the polder were tilled only superficially in preparation for the laying down of grass. Land destined for cultivation was ploughed at first to a depth of about 4–5 inches, but as it gradually acquired better structure, the depth of ploughing was increased to 6–8 inches. In the early stages, the land was too soft even for using horses, and so the work was done by caterpillar tractors with the caterpillars broadened by wooden blocks. Later, considerable improvement of sandy soils underlain by clay subsoils was brought about by deep digging or ploughing, the underlying clay being brought to the surface, where it quickly

weathered and became incorporated with the sand. In some instances this involved ploughing to depths of 4½ to 6 feet.

Cultivation and cropping

The early years of cropping were the responsibility of a special development company set up by the Wieringermeer Administration. The object was to bring the soils of the whole area into a state of fertility at the same time as the land was being subdivided and the farmhouses built. In this way, by the time the farms were ready to be thrown open to leaseholders, the land had already carried several crops, including at least one clover crop.

The work was organized by dividing the land first into large blocks of 700–1,200 acres, on each of which was built a reclamation barn for the housing of the necessary seeds, fertilizers, implements, etc. Each of these blocks of land was in charge of a manager, working under the supervision of an inspector. While the land was being improved, the future farmhouses, with big barns and cattle byres attached, were being built. Arable farms varied in size from about 70 to 150 acres, according to the type of soil, and there were also some allotments of 50 acres.

Cropping was adjusted to the nature of the soils, the general plan being to grow cereals with undersown clovers until a good crop of perennial clover could be taken. Rye was the first crop grown on the lightest land, barley on intermediate land, and winter wheat (Carsten V) on the heavier land. Not every crop sown was a success. In wet weather, for example, the structure of some soils collapsed and crops failed, or in periods of drought, salt rose to the surface and adversely affected growth. On the whole, however, as a result of the great care taken, yields were satisfactory and improved every year.

After the farms were taken over by the tenants, soil improvement continued and some diversity of cropping was introduced; for instance, the area under pulses (mainly peas) increased from 1·3 per cent in 1935 to 17·6 per cent in 1941, and that under flax rose from 6·5 per cent in 1936 to 13 per cent in 1941. Root crop acreage remained low, however, during the first years, and even in 1941 potatoes were grown on about 3 per cent of the land only.

From the time when the trial polder was established, a team of scientists, including chemists and microbiologists, watched over the growth of the crops. The great value of clovers, and later of other legumes, in improving soil structure was soon confirmed, but it was found to be very beneficial, and in some instances essential, to inoculate the seed with the correct nodule bacteria before sowing; lucerne, black medic, lupin and serradella failed completely if they were not inoculated. This inoculation of legume seed on more than 40,000 acres—often more than once, because of the different types of legumes grown—must surely have been the largest undertaking of its kind ever carried out. Some 700 tons of seed were treated before sowing, using over 2 tons of inoculum, prepared on agar medium.

Another problem solved by the scientists was cattle diarrhoea, which at first caused a great deal of trouble on the new pastures. It was soon found to be due to copper deficiency and was remedied either by dosing with copper salts or, at a later stage, by dressing the pastures with 25–30 lb of copper sulphate per acre.

A community takes shape

Much more could be written about the farming experience gained in developing the polder, but an equally interesting aspect was the planning and development of the community. Careful consideration had to be given to the functions of the governing and managing organizations, the supply of labour, the building of houses and farm buildings, leasing of the lands, laying out the villages, the introduction of the trading classes, planting of trees, public health, education and religious care, and public utilities.

Difficulties were experienced in the early stages because this was an entirely new field of State enterprise. For municipal tasks, the polder was at first divided among the five adjacent municipalities, who, realizing that this could be only a temporary arrangement, were naturally reluctant to make the heavy financial sacrifices required for rapid development. The Wieringermeer Administration was therefore forced to take over various municipal responsibilities, but in the absence of recognized competency in matters of public law, it had to reach its aims through its powers of disposal of the new lands. By making the leasing of the lands subject to certain stipulations, the Administration was able to lead the colonization into the desired channels, until an Act of Parliament conferred on it the status of a Public Authority, from January 1, 1938.

The initial work on drainage, road-making and other tasks was performed by a force of about 2,000 labourers. Next to be selected were the farm managers for the 1,000-acre blocks into which the land was first divided to bring it under crops. As the land was subdivided into farms and allotments, tenants were selected from a long list of applicants. The Administration was able to set high standards, taking into account practical experience, technical education, financial resources and other factors. Some of the smaller allotments were leased to market-gardeners from the adjacent municipalities and to labourers who had worked well for the Administration.

Not all the farms were leased to private occupiers. Thirty-seven of them, situated in different parts of the polder on the various soil types were retained for permanent exploitation by the State. These were run as far as possible like private farms, each with its own separate accounts; they provided valuable information for the Administration, not only on what was agriculturally possible, but also on what was a fair leasing value for the lands.

The rentals of the private farms, besides being based to some extent on the results from the State farms, varied in the early years with the prices of agricultural commodities—a system that was later abandoned. The leases included clauses guaranteeing extension in the event of good farming, etc., and one clause required a contribution of one per cent of the rental for the agricultural advisory society. The advisory and extension work organized through this society proved to be of great value in spreading knowledge of the best agricultural methods for the polder.

Three villages were established in the polder, near the junctions of roads and the bigger canals. It was estimated that eventually they would each house populations of 8,000 or 9,000 people. It was possible to plan them from the beginning, with houses in parallel streets away from the main roads; with industrial sections, recreation grounds, schools, churches of different

denominations, cemeteries, etc. The letting of sites to shopkeepers and tradesmen was closely controlled, so as to give lessees a reasonable income before competition was introduced.

Tree planting was extensive and included small areas of forest in the pastoral sections, shelter belts round farms and along roadsides and some canal verges, and recreational woods near villages. For the shelter belts, the quick-growing poplars and willows were mainly used with a lower " storey " of ashes, maples, black alders and mountain ashes.

"*Build on!*"

On April 17, 1945, when the war was almost at an end, the efforts of fifteen years' constructive work were brought almost to naught by the wanton flooding of the whole area by the retreating German army. More than 7,000 inhabitants had to flee precipitately and seek refuge in the neighbouring districts. Their houses, furniture and all their belongings were submerged for months under the waters of the Ijssel Lake. Not a word of recrimination appears in the souvenir volume, compiled by men who had toiled for more than twenty years to build up this magnificent undertaking—just the bare words: " the occupation authorities decided to inundate this new land ". Immediately the enemy had gone, all energies were turned to mending the breaches in the dykes and to manning the pumps. The polder was pumped dry again and in the following year fields were again being cropped and the shattered houses and buildings repaired. Once again there is a thriving, industrious community in the Wieringermeer polder.

No one need hesitate to dip into this book because he cannot read Dutch. The story of development is well told in the 200 pictures alone, all of which have English captions. Much more information than has been touched on here is included in the 60 pages of the English summary. The book concludes by quoting the simple words inscribed on the base of a statue called *The Reaper*, which was erected in 1942 in one of the Wieringermeer villages—" Build on! " How appropriate are these words, expressing the spirit of the Dutch in tackling these vast undertakings!

Senecio

At first acquaintance, surely the name Senecio conjures to the mind some sun-drenched spot on the coast of southern Italy where, beneath a cloudless blue sky, the surf creams along the hot sand and swarthy fishermen linger over their nets. In point of fact, it denotes one of the largest families of flowering plants, of which that bane of farmers, the common ragwort, is the outstanding member. Wherever there is sunshine, it has been said, there is ragwort, and certainly its wind-sown seeds appear to need little more encouragement than that to spring into virile life.

But farmers may draw some consolation from the philosophy that no condition is so bad that it cannot be worse, for, out of the two thousand listed, only about a dozen species of Senecio occur in the British Isles. In particular, besides the Common Ragwort, we have its twin the Marsh Ragwort luxuriating along the margins of streams and ditches, the alien Oxford Ragwort, the Hoary Ragwort of the hedgerows, the Silver Ragwort of sea cliffs and shingle beaches, the distinctive Field Ragwort of the chalk downs, and the giant Sarencen's Woundwort (delightful name!) which may reach a height of five feet, to say nothing of the common groundsel. The Great Fen Ragwort, which once infested the fens of E. Anglia, is luckily now extinct.

We are indebted to Linnaeus for his inspired choice of the name Senecio for this genus, derived from the Latin "senex", meaning old man—an allusion, we are told, to the white down surrounding the calyx of the flower. Its earlier name, as recorded by Gerard, was St. James's Wort, so called since traditionally the apostle made great use of the plant in the healing of the sick. Indeed the old herbalists, believing that "nought so vile that on the earth doth live, but to the earth some special good doth give", made much of its virtues. They claimed it was good for "greene wounds and olde filthy ulcers which are not scoured, mundified and made cleane". Likewise it was esteemed as a remedy for aches and pains in the limbs and "to take away the olde ache in huckle bones called Sciatica"—another attributive reason perhaps for the choice of its generic name! As with other common plants, however, country folk have seen no reason to burden themselves with the exactitudes of botanical nomenclature. Local epithets were good enough for them, such as Stinking Willie, Doddies, Cankerwort and Staggerwort.

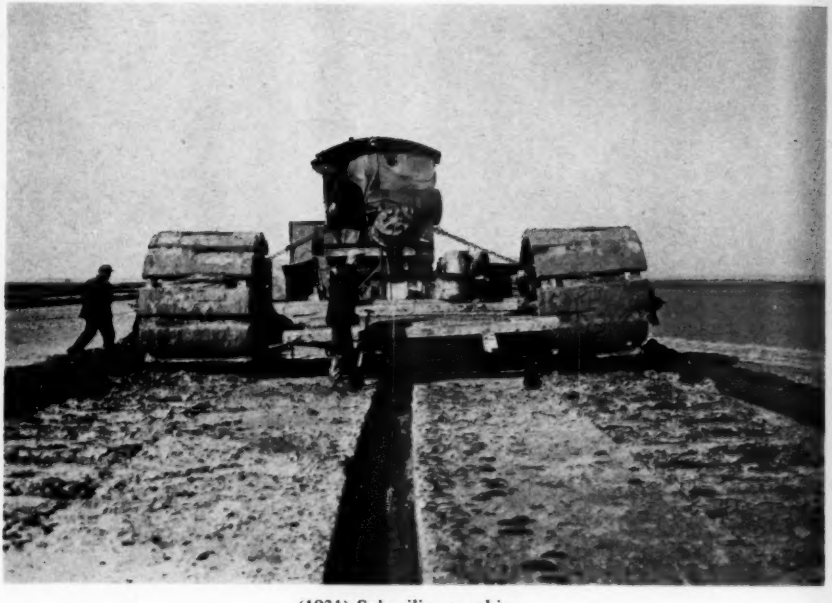
But to the modern farmer, ragwort is just a troublesome weed and one disastrous to his cattle if fed in hay, silage or dried grass. He will therefore advisedly attack it wherever it is seen. Close grazing with sheep, once thought to be a useful form of control, is now known to be a dangerous risk, and although the grubs of the colourful Cinnabar Moth have been known to decimate the plants, their numbers now appear to be much fewer and their co-operation therefore less certain.

Modern salvation lies in the growth-regulating sprays MCPA and 2,4-D, especially the latter, applied at the end of June or in early July when the young flower-buds are becoming visible. For relief from the ache in huckle bones and allied complaints of old age, we must transfer our faith from the Herball to the modern pharmacopoeia.

S.R.O'H.

Photo: *Geoffrey N. Wright*

***Senecio jacobea* L.**



(1931) Subsoiling machine.

Photos: *Maaskant, Holland*

(1954) Deep ploughing—to 6 feet.

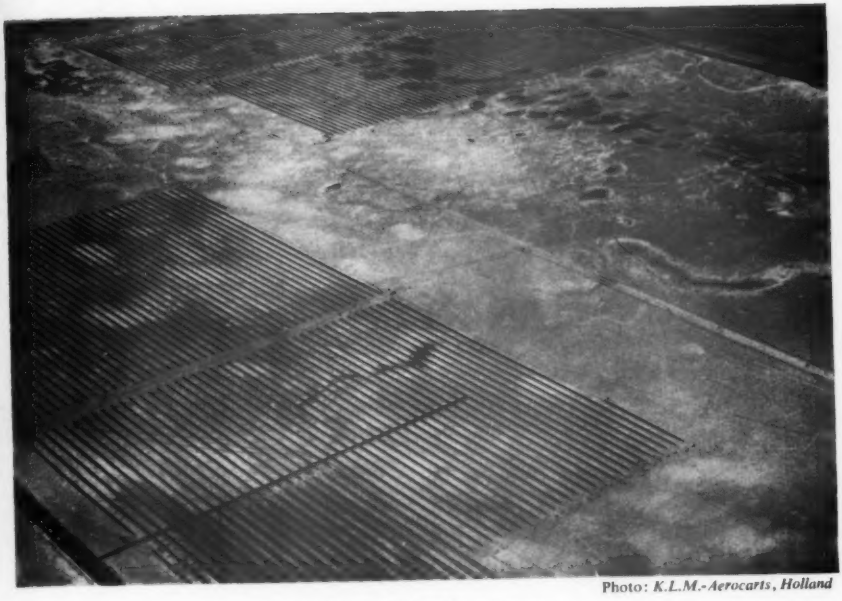
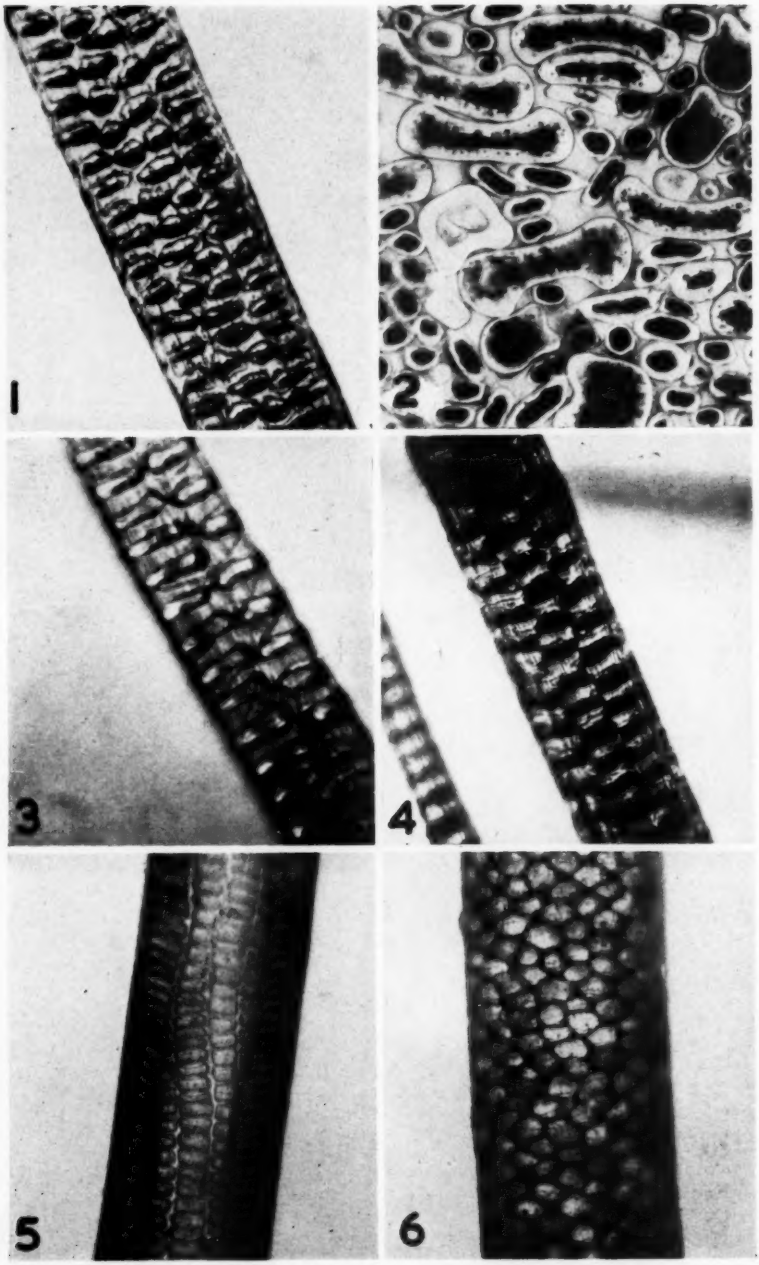


Photo: *K.L.M.-Aerocarts, Holland*

(1931) Trenching in progress.

Photo: *Maaskant, Holland*

(1933) One of the reclamation barns, used for housing seeds, fertilizers, implements, etc.



Photomicrographs and hairs of some mammals eaten by foxes.

1) Field vole (whole mount); (2) Field vole (cross-section); (3) Wood mouse; (4) Grey Squirrel; (5) Rabbit; (6) Fallow deer.

Magnification of Nos. 1-5 is x 360, and No. 6 x 90)

Ragwort Poisoning

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Ragwort poisoning kills. Farmers cannot be too careful to ensure that their cattle, sheep and horses have no access to this ubiquitous weed, especially in a conserved fodder crop.

MOST farmers are able to identify ragwort (*Senecio jacobaea* L.) as the ragged-leaved, yellow-flowering weed that grows in every county in England, Wales and Scotland, but how many know that it can be poisonous to cattle and horses and that sheep cannot always eat the plant with impunity? Forsyth[1] has stated that "Ragwort alone probably causes more annual loss to the livestock industry than all other poisonous plants put together" and has remarked upon "the enormous quantities which grow in pastures throughout the country".

Despite the fact that ragwort has been scheduled as an injurious weed, thereby making occupiers of land legally responsible for its destruction, it continues to spread. Growth normally occurs on poor, light land only, but the plant may now be found even on heavy soils. Thomas[2] has reported that myxomatosis has been one factor responsible for its increase; the plant is commonly grazed by rabbits, and in many areas where the rabbit population has been reduced it has grown in great profusion.

Ragwort is a killer

The incidence of ragwort poisoning in livestock in Great Britain is not known, but there is no doubt that many more cases occur every year, particularly in cattle, than is generally recognized.

Cattle and horses do not normally graze ragwort, but they will eat it if the pasture is bare and no other food is available. Sheep, on the other hand, eat the young plant and are commonly used to clean ragwort-infested grazings—a dangerous practice, as ragwort can be toxic to them as well. It has long been known that hay containing ragwort may be toxic when eaten over a period, but only recently has the danger of feeding silage made from ragwort-infested pasture become apparent[3, 4]. It appears that haymaking or ensiling does not destroy the alkaloids in ragwort which are the active principles responsible for poisoning. These alkaloids act mainly on the liver, which degenerates until unable to function properly and the animal dies. This process takes time, and a feature of ragwort poisoning is its insidious onset; several weeks, even months, may elapse from the time that the weed is first ingested until symptoms appear. The course of the disease also varies —from two days to some weeks. An outbreak in a group of animals may therefore be prolonged.

Symptoms vary according to the duration of the illness, but death is the invariable sequel. Typically, the first signs are loss of appetite and loss of condition. Constipation is common, but, strange to say, diarrhoea also occurs in some cases. Most affected animals strain continuously and eversion of

the rectum may be noticed. A staggering gait is often observed and occasionally the affected animal walks in small circles. Cattle may develop a mania and charge any person in the vicinity, whereas horses tend to become sleepy. When examined closely, the mucous membranes are seen to be pale or jaundiced. Affected animals become comatose just prior to death.

The main post-mortem finding is cirrhosis of the liver. The degree of cirrhosis varies, and the liver is sometimes as hard as a stone and difficult to cut even with a sharp knife. Ragwort may or may not be found in the rumen contents. Diagnosis is based on the history, symptoms and post-mortem findings, together with microscopical examination of the liver. Treatment is of no avail.

Prevention of ragwort poisoning is obvious: susceptible animals (cattle, sheep and horses) should not be allowed access to the weed. Under practical conditions, however, this is more easily said than done on farms where ragwort is present. The ingestion of a few leaves or flowers does no harm, but the critical level is not known. In a serious outbreak of ragwort poisoning in cattle fed on silage[4], the weed was found to be present to the extent of about 25 lb per ton in more than half of the crop.

Case history

A short account of this outbreak may be of interest, and at the same time act as a warning to those whose silage crops may harbour ragwort.

On November 1st, 1954, twelve courts were filled with 270 weaned cross calves and yearling cross bullocks which had been grazing on ragwort-free pasture. Draff, bruised oats, cake, turnips, grass silage and straw were introduced gradually, silage being given for the first time on November 10th and fed daily thereafter at the rate of 16 lb per head per day. All the cattle ate the silage and it was calculated that an average of 7·5 lb of ragwort were consumed by each animal during the three-month period that silage was fed. Three hundred tons of silage had been made from three fields.

At New Year it was recorded that the cattle were in excellent condition, but in mid-January, ten weeks after silage had been introduced, one stirk became ill and died on February 2nd. In the meantime, five stirks in other courts died within forty-eight hours of showing symptoms. Silage feeding was discontinued immediately ragwort poisoning had been confirmed (February 1st). Although it seemed certain that further losses would be incurred for some time to come, the farmer decided that his best policy would be not to salvage the remaining stock and cut his probable losses, but await developments and slaughter as many animals as possible whenever symptoms appeared. He had not long to wait. By mid-April, when the stirks (now yearlings) were put out to grass, 36 of the original 249 had died; none had been sent for slaughter. None of the two-year-old bullocks had died at this stage, but losses occurred in this group during the following months.

The turning-out of the yearlings to grass appeared to precipitate further losses, 12 stirks dying within forty-eight hours. Cases continued to occur sporadically in both age groups until the middle of August, by which time 61 cattle had died and 32 more had been slaughtered after showing symptoms. It is of interest that five of the twelve apparently normal yearlings sent for slaughter in November and December 1955 (a year after silage had

first been fed) showed mild cirrhosis of the liver. A further point of interest is that a significantly higher percentage of bullocks (40 per cent) than heifers (27·5 per cent) died or were salvaged during the outbreak.

The long latent period (ten weeks) before the first stirk became ill and the subsequent time-lag of several months are typical of outbreaks of ragwort poisoning. As can be appreciated, it was a most harrowing experience for the farmer concerned. The economic loss was huge—thousands of pounds—involving not only the livestock but also the silage that had to be discarded, together with labour costs at every stage.

Ragwort had been present on this farm in previous years and had been included in the silage, but only in very small quantities. In 1954, the weed was abundant, particularly in one field of second-year grass from which silage had been made. The farmer, in common with many others, did not appreciate the danger of making silage from a field heavily infested with the weed. A second factor that may tend to diminish in the mind of the stock-owner the serious consequences that may arise from including ragwort in the diet is the insidious onset of an outbreak. The ingestion of some plants—for example, yew and rhododendron—causes acute illness and a quick death. The sudden, calamitous nature of such losses is dramatic and quickly appreciated. Not so ragwort poisoning. Finally, an impression may be held that because cattle do not normally eat the growing plant they will also reject it if included in hay or silage. Yarded cattle, however, generally have no choice in the foodstuffs they consume, and if ragwort is present in the feed they will eat it.

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Liming on the Yorkshire Wolds

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It is claimed that the benefits derived from liming on the Yorkshire Wolds are negligible, and that most farmers in this area could save money without loss of crop.

WHY do farmers continue to use thousands of tons of lime every year on the chalk soils of the Yorkshire Wolds? This question has puzzled people in the north for a long time, and it is one to which no definite answer can be given. The Wolds make a wide sweep west and south from Flamborough Head to the Humber a few miles west of Hull. They form rolling country ranging to an altitude of 800 feet, sloping down to the south and east from the steeper scarps along their north and west extremities. Most of the land is given over to arable cropping and is under a four- or five-course rotation based on wheat, roots, barley and seeds, although some farmers now include potatoes, sugar beet and even leys. Sheep are important and under the traditional system graze the one-year clover leys in summer and feed on turnip and swede crops in winter.

Wold soils are derived directly from the chalk over most of the area, although to the east and south the true chalk soils merge into the deeper loams from the glacial drift overlying the solid rock. Typical wold soil is often only four to five inches deep lying immediately over broken rock, but deeper soils do occur, probably where the retreat of the ice in glacial times left thin patches of drift material. The dry Wold valleys also have a very good depth of soil. In recent years soil depth has been increased on many farms by the introduction of the deep ploughing necessary for such crops as potatoes, and this has resulted in the mixing of large quantities of chalk debris with the original shallow top soil.

Alleged benefits

The use of lime does not appear to be restricted to any particular area or crop; some farmers use it regularly, others not at all. Farmers' views on the type of lime which gives the best results under particular conditions also vary. Some are content to use the locally-produced, and therefore cheaper, ground chalk; others insist on burnt lime or some form of waste lime, although these materials are more expensive. On the Wolds, as in other areas, it is claimed that lime is necessary to counteract soil acidity, improve the yield and quality of crops such as barley, and reduce the incidence of Finger-and-Toe, which is prevalent in some areas because of the frequency with which turnips and swedes are grown. The continued use of such large quantities of lime certainly suggests that some benefits follow its application.

The question of soil acidity has been examined; the results of some of the soil sample analyses made at the N.A.A.S. laboratories in Leeds have been investigated and the indication is that the proportion of acid fields is small—probably not more than 2–3 per cent of those examined. The areas which

require lime are usually those in the dry valleys or "dales", where the soils are deeper and the fields have been under grass for many years. In such circumstances lime is washed out of the top soil, which then becomes acid. Elsewhere, serious acidity occurs in the pockets of deeper drift soil which can be found here and there on the Wolds.

From the point of view of soil acidity it would appear that liming is required only in a small proportion of fields and that much of the soil contains enough free lime to provide sufficient reserves to last indefinitely.

Another reason for applying lime could be to supply the magnesium essential for crops. Chalk itself has only a low magnesium content, and in some areas there might be a case for using magnesian limes. There is little evidence, however, that magnesium deficiency is a serious problem on the Wolds, or that farmers who use lime prefer types containing this element.

Farmers in the area also use lime because it is said to improve either the yield or quality of their crops. Yield increases would, of course, be expected in the local areas where the soil is acid, but elsewhere lime (with the exception of some of the waste limes which contain small amounts of nitrogen) would not be likely to have much effect.

Experiments, yields and quality

Two experiments to measure the effect of lime on the cropping of chalk soils were carried out in 1952-54 at the High Mowthorpe Experimental Husbandry Farm in the north-west of the Wold area, and the results have been reported by Rennie.* It was intended to carry out one experiment on an acid soil and the other on land well supplied with lime, but when the sites were finally selected both were found to be about neutral in reaction (pH value 7·1 and 6·8 respectively). Four types of lime—ground-burnt lime, ground oolitic limestone, ground chalk and ground magnesian limestone—were used and each was applied at three rates equal to 1, 2, and 4 tons per acre ground limestone. Yields were assessed for three years on each site, the crops grown being swedes (1952), barley (1953) and clover (1954).

Some of the results obtained from Site 2 (pH 6·8) were:

	1952	1953	1954
Lime Rate *tons/acre*	Swedes Yield *tons/acre*	Barley Yield *cwt/acre*	Clover (dry matter) Yield *cwt/acre*
Nil	19·8	40·1	32·7
1	20·0	40·6	30·4
2	19·0	40·2	31·4
4	19·7	41·0	31·2

Although four types of lime were used, the difference between the respective yields was negligible, and the yield figures given above for the limed plots are averages. Similar results were obtained on Site 1 (pH 7·1).

The conclusion drawn was that lime had had no effect on yield on either site. There was no evidence that the crops from the limed plots were better in quality or superior in any other way to those from the unlimed controls. In the case of the clover crop, there was a fairly serious attack of Clover Rot,

* An investigation into the liming of Wold soils. G. K. RENNIE. *Exp. Husbandry*, 1957, **2**, 76–7.

but all plots were affected uniformly. These results show that at least on the High Mowthorpe soil no benefit may be expected from liming, and it can confidently be expected that chalk soils in other parts of the Wolds would give similar results.

The effect of lime on crop quality is more difficult to assess in a general way than its effect on yield. It is almost impossible to measure the factors which combine to give a crop of good quality. There is, however, nothing to show that farmers who regularly use lime can produce better samples of barley or wheat for malting or milling, or that quality differences in other crops grown by them are related to liming policy.

Liming and disease

Yet another reason given for the use of lime is the prevention or control of diseases such as Finger-and-Toe. It has long been known that the fungus which causes Finger-and-Toe flourishes under acid conditions, and recommendations to apply lime where the disease occurs are often made. On the Wolds, Finger-and-Toe is found on soils which are already about neutral in reaction, and in such cases it is unlikely that liming would be of great value. The comparatively short interval between successive swede crops on many Wold farms is probably of much greater importance in relation to the occurrence of the disease than the presence of lime in the soil.

The other disease which is widespread in the Wolds is Clover Rot, and this affects seed crops quite badly in some seasons. Lime is often said to be necessary for satisfactory growth of clover, but there is no evidence that the incidence of Clover Rot is in any way affected by liming.

Is liming really worth while?

Although lime in various forms is widely used in the Wolds, there is little or no justification for the belief that it has any special value on the chalk soils of the area. Probably because of the types of crop grown, there is at present little trouble from overliming—a serious problem on chalk soils in the south-east of England—but if the system of farming changed on the Wolds, this aspect of the liming question might become more important.

It would seem that the use of lime on Wold soils could be cut drastically without reducing crops and with a consequent saving in money to the farmers of the area. After all, there is still plenty of acid land in other districts where the lime being produced in and around the Wolds could be absorbed and where the resulting higher yields would give increased profits to farmers.

THE MINISTRY'S PUBLICATIONS

Since the list printed in the March 1957 issue of AGRICULTURE (p. 596), the undermentioned publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.

BULLETINS

No. 37 Silage (*Revised May 1956*) 3s. (3s. 2d. by post)

No. 77 Tomatoes—Cultivation, Diseases and Pests (*Revised October 1956*) 4s. 6d. (4s. 9d. by post)

No. 81 Peas (*Revised September 1956*) 3s. (3s. 2d. by post)

No. 145 Farm Roads (*New December 1956*) 4s. 6d. (4s. 9d. by post)

No. 164 Hop Growing and Drying (*New December 1956*) 5s. (5s. 3d. by post)

No. 166 Sheep Breeding and Management (*New November 1956*) 5s. (5s. 3d. by post)

OTHER PUBLICATIONS

Experimental Husbandry No. 2 (*New February 1957*) 3s. 6d. (3s. 9d. by post)

Register of Accredited Poultry Breeding Stations and Accredited Hatcheries (*Revised January 1957*) (Free)

LEAFLETS

Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (5d. by post) and 2d. (4d. by post) respectively.

ADVISORY LEAFLETS

No. 10 Fruit Tree Red Spider Mite (*Revised February 1957*)
No. 67 Lucerne (*Revised February 1957*)
No. 154 Fruit Tree Capsid Bug (*Revised February 1957*)
No. 247 Seed Testing for Farmers (*Revised February 1957*)
No. 283 Advice to Intending Beekeepers (*Revised January 1957*)
No. 329 Management and Manuring of Orchard Soils (*Revised February 1957*)
No. 333 Orchard Renovation and Improvement (*Revised February 1957*)
No. 335 Rootstocks for Apples and Pears (*Revised February 1957*)
No. 344 Migratory Beekeeping (*Revised February 1957*)
No. 360 Outdoor Tomatoes (*Revised February 1957*)
No. 437 Farmhouse Butter Making (*New February 1957*)

ANIMAL HEALTH LEAFLETS

No. 23 Tuberculosis of Cattle (*Revised February 1957*)
No. 24 Twin Disease in Ewes (*Revised November 1956*)
No. 37 Pullorum Disease (*Revised January 1957*)

FIXED EQUIPMENT ON THE FARM

No. 17 Preservation of Timber and Metal (*Revised March 1957*) 1s. (1s. 2d. by post)

FREE ISSUES

Obtainable only from the Ministry (Publications), Soho Square, London, W.1.

FARM MACHINERY

No. 9 Potato Diggers (*New January 1957*)

MISCELLANEOUS LEAFLETS

A Career in the National Agricultural Advisory Service (*New January 1957*)
Grants for the Eradication of Bracken (*Revised April 1957*)
Pea Root Eelworm (*New March 1957*)
Silo Subsidy Scheme (*Revised April 1957*)
Spray Drift Damage to Crops (*New March 1957*)
The Menace of Potato Root Eelworm (*New January 1957*)

Sewage Irrigation Farms in the Nineteenth Century

G. E. FUSSELL, F.R.HIST.S.

With the growth of industrial towns during the nineteenth century, the problem of the economic disposal of sewage became urgent. To some enthusiasts, sewage irrigation farms offered the solution.

THROUGHOUT the ages ingenious men have tried to discover new and improved methods of farming. Some of these were quite fantastic (or seem so now), while others proved practical and advantageous. In the mid-nineteenth century two factors combined to stimulate interest in the possible use of town sewage as a valuable and cheap manure—the expansion of London and the concentration of population in the new industrial towns, and the catastrophic outbreaks of cholera. The disposal of large quantities of sewage was a problem which was both new and urgent.

There was a constant search for new fertilizers and it was not surprising that the successful experiments with sewage on the Craigentinny meadows in Scotland and the use of Peruvian guano led to the belief that sewage would be a cheap but rich source of renewed fertility, and so meet the rapidly increasing demand for food.

Between 1840 and 1890 the use of sewage was widely discussed in agricultural literature, at first with unbounded enthusiasm, and later in a more cautious tone, as great chemists, like Sir John Lawes, examined the possibilities of the material more closely. Similarly, there was continuous discussion of the problems which faced town authorities and river boards—rapid disposal of an unwanted product was essential, and the dangers of river pollution had to be overcome. Royal Commissions were appointed and Select Committees sat. Experiments were made and considered. It took nearly half a century to determine that town sewage was not the cheap and miraculous fertilizer that its protagonists at first proclaimed it to be.

Success in Scotland

The Craigentinny meadows were once a sea beach forming a sandy waste between Edinburgh and the coast. Some of the town sewage was directed to it as early as 1734 and resulted in a small measure of haphazard reclamation. The land, being sandy, allowed the excess liquid to soak away much cleansed into the sea. Thirty years later enterprising farmers had laid out about 40 acres something like a water meadow, and this was extended to about 300 acres in the following century. The method was quite simple: town sewage was collected and allowed to stand while the solids settled, and the liquid gravitated towards the estuary along an open ditch, pleasantly called the "Foul Burn". From this ditch the farmers irrigated their land. The soil was covered to a depth of about four inches, and as the water soaked through, its fertilizing properties were left in close contact with the plants,

but not deep enough to contaminate them. Heavy crops of meadow grass and of Italian ryegrass were cut green or for hay, and largely used for stall-feeding dairy cows in Edinburgh and other nearby towns. It was often possible to make four cuts of meadow grass and five of ryegrass during the summer, and yields equal to those of the prolific water meadows of northern Italy were obtained. It is no wonder that, with such an example before them, enthusiasts should have thought the huge volume of London sewage an unrestricted source of agricultural wealth.

An urgent problem

Town sewage was of very mixed composition, and it was therefore thought likely to serve well as a substitute for farmyard manure: one enthusiast pronounced it to be the very best of all general manures! The material included rainwater from the streets, with droppings from horses and other livestock, the silt from yards and causeways, the foul water of kitchens, waste water from factories, the cleanings of water closets, and all the filth not readily removable in carts. While the escape of sewage into rivers and the sea was considered a waste of valuable material, it was also recognized that the method of its dispersal was a menace because of its noxious exhalations and pollution of useful streams.

It was not surprising then that in 1849 the Metropolitan Sewage Manure Co. was formed. This company proposed to pipe the liquid from what must have been an outfall at Stanley Bridge and erect stand-pipes in neighbouring gardens and farms, so that consumers could take supplies. Farmers were expected to buy great quantities of it at 6*d*. a ton—in spite of Lawes's warning in a lecture at the Royal Society of Arts some years before that London sewage was likely to be too diluted to be of much value, unless applied in vast quantities. An even more ambitious scheme was propounded in the 1860s—no less than to pipe London sewage to Maplin Sands, Essex, and thus make an area of 7–8,000 acres as profitable as Craigentinny.

One of the main factors in support of the scheme was the urgent problem of sewage disposal. In 1852, Philip Pusey remarked that many towns had just completed new sewage arrangements and did not know what to do with the outfall. If, said a speaker at the Royal Society of Arts, an economic method of disposal could be devised which would profit farmers and not give offence to nearby residents, the problem would be solved. It may have been an unconscious urge to accept this solution that caused so many to over-estimate the fertilizing value of the material. J. Thomas Way, advisory chemist to the Royal Agricultural Society, perceived this conflict of interests. In his opinion, many of the plans were speculative and had been originated in ignorance of the facts. He did not think that any of the projects for making solid manure were likely to succeed and suggested that even the liquid, which was more useful, was so diluted as to be of doubtful value. Liebig came down on the opposite side and deplored the waste of valuable material.

Meanwhile a few practical men had been using the fertilizer and gaining experience. The Earl of Essex, Chairman of the Royal Commission on the Sewage of Towns, rented the sewage of Watford, and piped it to 210 acres of mixed arable and pasture land. He found that it was best used on grass, and

applied it mainly to 10 acres of Italian ryegrass and 35 acres of meadow grass, using 5,000 tons a year. But by 1863 he had abandoned the practice.

Attempts at solution

The experiences at Rugby were typical examples of many sewage projects. A Mr. Campbell laid down pipes for about 190 acres, but finally gave up using sewage, except for some 12 acres of permanent pasture and Italian ryegrass. Later all the town sewage was collected in a large tank and distributed by steam-power, through iron pipes, to 470 acres of mixed arable and pasture land. But no profits from all this capital expenditure were forthcoming; cows gave less milk and fattening beasts gained only a quarter of the weight usually attained with ordinary feeding. These results compared unfavourably with those obtained at Craigentinny meadows, and the difference was attributed to the much lower weight of sewage applied per acre at Rugby.

By 1867, several other towns had provided manure for farm lands. In Leicester it was found impossible to make cake or *poudrette* from sewage, although something of the sort had been tried at Cardiff gaol, where, after chemical treatment in tanks, the solids were moulded by hand and stove-dried. At Hyde, in Lancashire, there was an elaborate system of collecting night soil, mixing and straining it, and adding coal ash; this was satisfactory from a sanitary point of view, but the end product proved a poor manure.

At Croydon, where there had been an outbreak of pestilence attributed to bad sanitation, the liquid manure system was adopted and the land more liberally treated than at Rugby. Cattle were said to fatten better and milch cows also did well. The Alnwick authorities had tried the process and abandoned it by this time, but at Carlisle, Malvern and Tavistock, meadow grass and Italian ryegrass were fertilized in this way. At Worthing, too, it was proposed to submit 42 acres to the treatment.

In the third report of the Royal Commission on Town Sewage, one of the conclusions reached was that sewage should be applied to the land as a liquid, particularly to crops of Italian ryegrass. The direct result, it was hoped, would be an enormous increase in the production of butter, milk and cheese, but towns might have to face a financial loss to secure a sanitary advantage.

A sewage-irrigated farm at Aldershot was producing remarkable crops of ryegrass in 1871, although the land around it was a sterile waste of sand. The sandy soil seemed well suited to this method of fertilization, and so indeed were the gravels at Barking and Romford, where various good crops, including strawberries, were produced. Generally speaking, Italian ryegrass seemed to be the crop which benefited most from sewage, and the view was held in some quarters that the farmer using sewage had an undoubted advantage where milk production was concerned.

Many methods of dealing with sewage were tried by many towns. From Doncaster all sewage was directed daily to a 263-acre farm where cereals, garden crops as well as prolific crops of Italian ryegrass were grown and considerable numbers of cattle and sheep maintained. A similar pattern was followed at Leamington, sewage being pumped nearly two miles to the Earl of Warwick's estate. Cheltenham had a sewage-irrigated farm, but also pro-

duced a solid fertilizer; the sewage was filtered in tanks, the liquid flowing on to the land and the sludge being lifted by a turbine and mixed with ash and house-waste which had been collected in scavengers' carts. This by-product was sold to market gardeners and farmers at 2*s.* a cubic yard (2*s.* 6*d.* if screened).

Enthusiasm wanes

Although all these and other towns had adopted similar sewage disposal plans, the optimistic protagonists of agricultural sewage were destined to disappointment, for nowhere in England had the Edinburgh-Craigentinny success been repeated. It was difficult to find a market for sewage fertilizer, and any benefits derived were more than offset by the heavy cost of distribution. Only plants of succulent growth flourished on sewage; Italian rye-grass and a few other grasses were stimulated, but were rarely satisfactory in the second year of growth. Yet in 1876 sewage disposal through farming was still thought to be the only satisfactory method. Chemical disposal had yet to be devised.

As time went by the opinion of sensible people was that sewage was a nuisance and certainly no mine of wealth. There was also a growing prejudice, possibly only fanciful, against the use of this fertilizer for crops grown for human consumption.

The sewage irrigation of fodder crops continued, however, during the 1890s, but the rapid growth of the urban population made it increasingly difficult for the comparatively limited area under treatment to consume all the output. Even the successful undertaking at Craigentinny meadows was overwhelmed and a good deal of the excess flowed into, and polluted, the Firth of Forth. Rarely could all the sewage of a town be consumed and sterilized, and some method had to be devised to dispose of the surplus with safety. It became obvious that the whole quantity must be disposed of by the mechanical and chemical methods which had, in the past, been used for only part of the material. This meant that unwilling farmers no longer had to be persuaded to adopt the process and the large and complicated installation that was involved; it was perhaps mainly for this reason that the sewage irrigation farm, which had been so widely acclaimed half a century before, disappeared from the countryside.

Month in the Forest

J. D. U. WARD

Sheffield blight—Weeding and Cleaning—Ivy—Intensive work

EVEN in an average year a forester usually starts his weeding operations before mid-June. This year's early weed growth has been such that many of us were busy before mid-May. Most young trees are under 18 inches high when planted out (some are under 10 inches), and the weeds on fairly good but dirty ground may make weeding, or rather finding the trees and avoiding topping them, an exacting job. One of the stock occupational and seasonal jokes is a reference to "Sheffield blight": if a forester thinks too many of his trees have tasted cold steel, and relations with his men are good, he may comment that "It'll take this lot more than a year to recover from this week's Sheffield blight". If relations are not good there will be less euphemism!

The whole business of tending trees after planting is a complete mystery to the majority of people—even country people. Not infrequently I hear it asserted that once trees are planted they require no further attention. This is rather like saying that farming consists merely of sowing and harvesting: manures, ploughs, harrows and rollers would, by implication, become quite superfluous. In fact, the forestry position is complicated, and it is not made easier to explain or understand by the normal overlapping or confusion of such terms as "weeding" and "cleaning". Weeding most properly means the cutting of herbaceous growth in newly-planted areas. In a few places you may have to do this for only two years, but in many more it will have to be done twice in the first summer and once in each of the next two or three.

Cleaning normally relates to work at the next stage. The chief enemies then will be the harder-stemmed weeds—honeysuckle, wild clematis, ivy, brambles, elder, young thorn trees and crab-apples, sallow or birch. Some of these are bird-sown, and a plantation of any species which does not completely dominate the ground (by closing canopy and throwing a dense shade early) may still need an occasional cleaning more than a dozen years after establishment. Ash, oak and European larch are examples. These trees demand light and are therefore most vulnerable to damage if other plant life is allowed to overgrow them. On the other hand, species more tolerant of shade (such as beech and the spruces) stand a better chance if temporarily smothered.

There are far too many complications in this department of silviculture for any brief or generalized outline to be satisfactory. For example, in certain (not rare) circumstances associated with drought or with sites that dry out quickly, as concave hillsides, a forester may know that he mustn't weed young plantations too thoroughly: controlled weed growth is a desirable protection for both trees and soil against scorch and drying winds. An offshoot of this principle concerns poplars. If you are cutting weeds in a poplar plantation or avenue, it is sound practice to use the soil as a mulch immediately round the stems—to conserve moisture and weaken weeds.

Incidentally, on certain soils, or too well-drained rocky slopes, early summer droughts can bring very heavy casualties in new plantations. Losses of 75 per cent are not unknown when a drought comes before planted trees have taken hold.

Another complication. Certain cleaning operations carried out when trees are perhaps ten or fifteen years old might improve the appearance of a plantation, making it look as though someone owned and really cared about it. Yet they can be omitted if labour or money is short. If you know that the right trees are going to come out on top, undamaged, in their competition with (say) elder or brambles, it is not sound economy to send in men to cut rubbish that will be crushed by the trees themselves in another few years. The rights and wrongs of these questions are largely dependent on circumstances; it is part of the experienced forester's duty to be able to make a right judgment.

Ivy is a particularly contentious weed. A well-meaning society has recently busied itself with anti-ivy propaganda and warnings that ivy is killing Britain's trees. Ivy-lovers have replied with statements that ivy does no harm and couldn't kill a healthy tree. Both these extreme positions are unsound. Ivy is an undesirable weed in young plantations, and is likely (if not discouraged) to slow down growth. But to find any tree which has attained a height of 20 feet killed by ivy must be exceptional (I have myself never seen one), and to make a violent set against ivy whilst ignoring honeysuckle, which can do appalling damage, especially in ash, oak and larch plantations, suggests an emotional approach based on some such idea as "Ivy is dark and ugly; honeysuckle is sweet and pretty". What anyone does about ivy on old park trees or hedgerow trees already overmature is a matter of personal taste. If the trees are to stand as long as possible and then become firewood, and you like ivy, then let the ivy stay. Personally, I don't like ivy on trees—but then neither do I (with rare exceptions) like overmature or firewood trees.

In June, nursery work is perhaps simpler than work out in the forest, and it is certainly more amenable to mechanization. Weeds must be kept under and the top of the ground friable. Sometimes shelter against scorch must be provided—and watering may be necessary. In the nursery, man has greater powers of brute control. Out in the forest, he must more often go along with nature and, with discretion, give encouragement here and discouragement there.

In the past, most workers on private estates left the woods to help with haymaking and harvest. And although this very sensible practice still continues in some places, forest work today is more intensive than it used to be when a greater proportion of our woodland was semi-natural and not required to produce so much. Today, silviculture is relatively intensive; there are many more man-made plantations, calling for almost unremitting attention. And that holds good even in a "normal" or balanced forest, which must be rare in Britain!

Farming Affairs

Talking about poultry

This is a month when everyone who calls has suggestions for the betterment of your growing stock—some of them are useful and some of them are not. Nevertheless, it is a time when there are many things to do and it is easy to miss a point in the general rush. The one thing that must be emphasized is that growing stock *do grow*, and this means that the night ark which housed 60 chicks at 8 weeks will take only 30 at 12 weeks. I always feel that the best guide here is the amount of floor space which the chicks occupy when asleep at night, and if they are filling over 60 per cent of the floor space at this time, then they will almost certainly be too thick when moving about in the early morning before they are let out on range. As the chicks need more sleeping room, so they will need more air, and it is worth while making sure that the roof outlets are open wide enough and not filled with cobwebs, dust and feathers; a night visit and a nose poked inside the unit will tell you a great deal about the ventilation. These are points which the boss must check for himself and not leave to anyone else.

The water trough and feed space which were satisfactory three weeks ago may be quite inadequate by now, and the same thing applies to the size of grit and the quantities being given. Grit is often over-fed and wasted and I personally feel that it is much better to have a regular day each week when the chicks are given a supply which they can clear up in a couple of days, and then let them go without until the following week.

In a season such as this, grass is a very real problem to many poultry-keepers. From every angle it pays to cut as regularly as possible, and to lay out the unit so that cutting and handling are made easy. If the grass is cut regularly it can be left to rot down, but where long grass is left and then topped it is likely to become dry and stringy. About four years ago, I remember, we had a great deal of crop trouble with this kind of poor material.

Most people will by now have seen the incubation results from the three Progeny Testing Stations. The obvious feature through them all is the wide range of hatchability—running from 40 to 80 per cent. It will be interesting to see the results from the next hatch of eggs, which will be from birds actually housed on Progeny Testing Stations. The decision to allow, for the time being, only the entrants concerned to visit the stations will cause a good deal of disappointment. This must have been a difficult decision to make in view of the great interest that is being shown, but it is one which has the best interests of all in mind, for an outbreak of fowl pest at such a unit would not only kill stock but make years of recording quite useless.

The chicks are now in fold brooders and growing well; the mortality rate is satisfactorily low. It is surprising how efficiently the fold brooders manage to cope with the changes in our English climate and rear decent chicks; this equipment is certainly one of the post-war innovations of real value.

C. T. Riley

At the Farmers' Club

Farm Capital Investment

The opportunities presented by the Government's Farm Improvement Scheme were the focus of MR. STEPHEN CHEVELEY'S talk on 1st May. He sounded the advance, but he also enjoined caution; for "surely the last thing we want," he said, "is to see the administrative machine overwhelmed with hastily considered schemes or people rushing in to head a queue for capital grants, and it may well be that those with greatest justification for grants will need the longest time for consideration". It is imperative that capital investment of public money in farming should be done wisely and therefore in the interest of both farmers and the nation. The right approach is not to take headlong advantage of apparently cheap credit, but to correlate the grant to the carefully estimated return from the farm as a whole. So, he urged, before investing in buildings or permanent works, it is essential to consider whether the level of management and intensity of farming is adequate, and until these steps have been taken lack of investment in what might be called landlord's capital may not be a limiting factor. Put in another way, there is no point in investing fixed capital unless one can provide the stock or crops to use such investment.

Will the return expected from the infusion of new capital be adequate to pay back the investment and make the whole thing worth while? The answer to that question, Mr. Cheveley suggested, lies primarily in the level of the farm's net income and in the assumption of future agricultural prices. He thought that unless the resulting net farm income can be foreseen as a minimum of £520 per annum, additional investment may not be justified. Something between 10 and 15 per cent might be the target for the return on investment, although the figure might vary according to the type of farm.

"Landlords and tenants should regard this possibility of taking advantage of the Farm Improvement Scheme as a combined operation," said Mr. Cheveley. "It can yield benefit to both in the form of higher rents and higher profits. Even where the landlord undertakes the investment, he must co-operate very closely with the tenant, because if the investment is to yield a return the tenant farmer will often need to increase his investment in working capital. . . . Where the landlord will not undertake the investment though the tenant would do so, the tenant should surely be encouraged to go ahead, and we should consider again whether existing legislation is sufficient to safeguard his position with regard to compensation for improvements brought about by this investment."

Mr. Cheveley emphasized the importance of work study in farm buildings in view of the present-day cost of farm labour. The small family farm offers no hope of cutting out a man, and any increase in profit must usually come from greater output from the same labour. But on larger farms there is the alternative of achieving present production from less labour. "There is nothing magical about 'work study'," he said, "and many farmers have practised a form of it for years without giving it a specific title. But it is a science just as the feeding of livestock or the treatment of crops is a science, and I am convinced that the sooner it becomes established as an important subject in all agricultural training, the better.

"The challenge to our industry is clear," said Mr. Cheveley, "and unless it

be accepted with a degree of sustained effort and enterprise that has perhaps not yet been imagined, this once-for-all opportunity will be lost. . . . We shall all be responsible for helping this great scheme along."

Tractor sense

Is it better to keep special tractors for special jobs, or should each tractor be as versatile as possible, even though that means using it for jobs for which it is not quite suitable and which do not give it a truly economical load? The answer depends on individual circumstances; for example, the kind of farming and financial factors such as income tax reliefs which may affect the number of new tractors bought. Nevertheless, certain considerations remain pertinent, whatever the circumstances.

It must not be supposed that the rate of wear in a tractor varies directly with the load of work it performs. A vaporizing-oil tractor may be damaged less by hard continuous work than by intermittent light work. This is not so true of the diesel, which is not as likely to be damaged by cold running. But whatever the kind of engine, remember that much of the fuel is taken merely to move the tractor itself: for instance, an outfit running with the plough lifted out of work could still use more than a third of the fuel actually needed for full-depth ploughing. Therefore, let the load be as great as the tractor can pull without distressing the engine or causing the wheels to slip.

Both fuel and labour are saved by matching the tractor to the load and job, the latter especially where tool-bars, mower cutter-bars and front-loaders have to be removed. Nevertheless, keeping special tractors for special tasks can become expensive. The fixed costs of depreciation, interest on capital, and insurance for each tractor have very little relation to the number of hours the tractor is in use. Expenditure on repairs, maintenance and wages does not necessarily increase with the number of tractors kept; in fact, it may decrease when there are sufficient sizes and types to enable each job to be done at its highest efficiency.

On small farms, however, with only one or two tractors, the problem becomes not so much one of matching the tractor to the load, as matching the load to the tractor. A tractor pulling a two-furrow plough very easily could often pull three furrows of the same width without appreciable sacrifice in depth, so that an area half as large again could be covered in the same time with the same labour and very little more fuel. Unfortunately, this two-to-three ratio does not work out with headland-running, where the ease of handling gives the two-furrow plough the advantage. It is true that with some systems of ploughing the three-furrow implement is easier than a two-furrow for making a "finish", but, all the same, changing from a two- to a three-furrow plough rarely saves the time and fuel expected.

Another way to load the engine more efficiently is to increase the forward speed of the tractor. This works well with jobs such as harrowing, but there are many operations which must not be done at too high a speed, and for some of these it is best to use a high gear but a low engine speed. Jobs such as grass mowing rarely demand much power, and a low engine speed is generally likely to use less fuel and cause less wear. Do not set the speeds too low; some engines operated far below normal speed do not receive enough lubrication to protect their bearings.

All these methods of loading the engine efficiently are bound to save fuel and time if applied within reasonable limits, but as soon as the note of the engine becomes laboured and there is a suspicion that its speed is being pulled down below the governed speed, it is time to relieve the load.

H. J. Hine

Colorado beetle in 1956

In 1956, for the fourth successive year, no breeding colony of the Colorado beetle was found in potato fields in the United Kingdom, but fifty-one adult beetles were detected, all of them in England and Wales. The following table summarizes the discoveries, and figures for the previous two years are given for comparison.

	1956	1955	1954
Beetles associated with or on imported produce	21	27	20
Beetles found on ships	28	17	9
Docksides and beaches	1	0	0
Inland on potatoes	0	0	0
Inland miscellaneous	0	7	2
Odd dead beetles	0	3	3
On aircraft	1	0	1
	51	54	35
No. of breeding colonies	0	0	0

Of the beetles discovered on imported produce, eight were on lettuce from Spain (4), France (1), Italy (1) and untraced sources (2). Others were found on Spanish onions (2), French strawberries (1) and miscellaneous Spanish vegetables (2).

Eighteen beetles were found at Southampton in association with potatoes embarked as ship's stores at Barcelona; eight of them were found when the bags were being moved along the dockside from one hold to another, and ten more during a search of the ship. Some of these beetles had already started to wander along the dock. The eight beetles have been allotted arbitrarily to the first category in the table and the ten to the second.

Of the other beetles discovered on ships, eleven dead ones were found at Southampton in June in a grain ship which had recently arrived from Texas, U.S.A. The rest were living beetles found on ships carrying various cargoes including cork from Portugal (2) and timber from France (1). In May, one beetle was found on the hatch cover of a ship that had been berthed at Liverpool for some weeks; it seemed clear that it had flown from a passing ship during a spell of hot weather.

The general improvement that has been apparent during the last few years led the Ministry to decide to suspend its precautionary spraying programme. Emergency arrangements were, however, maintained in readiness for instant action if the occasion arose.

The Ministry greatly appreciates the support it has received from the public, the police and all concerned with the Colorado beetle campaign. Vigilance is still as important as ever and it is hoped that the prompt reporting of any suspected beetle will continue.

F. H. Jacob and H. W. Janson

In Brief

LEVINGTON RESEARCH STATION

Fisons's new research station at Levington, near Orwell, Suffolk, was opened by Sir Alexander Todd, F.R.S., on 7th May. Here, with 300 acres of light farmland and a 60-acre horticulture unit at the disposal of its laboratory staff and field workers, the search for new types and forms of fertilizers will be pursued with renewed vigour. Research is divided between the study of soil and agronomic problems, related to sound fertilizer practice and the investigation of new and improved chemical processes in the manufacture of fertilizers.

Over ninety agricultural and horticultural field experiments, spread over 4,000 plots, are at present in hand. Crop yields are determined and representative samples taken for chemical and botanical analysis. A foundation dairy herd of twenty Red Polls has been established at Red House Farm, and arable cropping, with an emphasis on self-sufficiency in herd management, is located at Levington Walk Farm.

The horticultural unit, embodying nine glasshouses covering half an acre and packing sheds, is devoted to research on such crops as tomatoes, cucumbers, apples, pears, soft fruit and carnations.

Touching briefly on the increasing world population pressure for more food, Sir Alexander Todd described it as "a crisis of peace, which presents both a challenge and an opportunity". Dr. J. A. Storrow, the Director of Levington, and his staff are preparing to do their part in meeting it.

EXPORT OF LIVE CATTLE

Lord Balfour's Committee enquiring into the export of live cattle from England and Wales to the Continent for slaughter have reported (Cmnd. 154) that the journey by sea or air to the Continent is not a sufficient reason for imposing a total prohibition on the export of cattle for slaughter, but that long train journeys on the Continent coming immediately after the sea crossing, and probably in many cases also a lengthy journey in this country, must inevitably cause the animals undue suffering, and cannot be justified. They recommend that exports should be allowed only to small countries such as Holland, where internal transit is short and where the Government concerned can give satisfactory assurances that the animals will not be re-exported; the method of slaughter must satisfy British requirements and the conditions of lairage and slaughterhouse facilities must be satisfactory.

Veterinary inspection at the ports should, it is recommended, be made compulsory, to ensure that no animal unfit to travel is allowed to be shipped. Other recommendations are designed to tighten up the conditions at the lairages where cattle for export are rested before shipment. Some changes in the sea transit regulations are envisaged and the need for strict enforcement of all regulations governing the transport of animals is stressed. The transport of animals by air is by far the most comfortable and least likely to cause suffering.

FOOT-AND-MOUTH ON THE CONTINENT

There has been a disturbing rise this year in the incidence of foot-and-mouth disease in Europe. The ultimate objective of F.A.O.'s European Commission for the control of this disease is eradication by systematic slaughter of all infected or in-contact animals. But since most countries on the Continent are not yet ready

to adopt so radical a policy, the Commission's immediate plan is large-scale vaccination, reinforcement of sanitary control measures to check the spread of the disease, and the prevention of its introduction into Europe from abroad. This should limit and reduce outbreaks considerably and so lead the way to the full slaughter policy.

TAKING THE GAMBLE OUT OF BREEDING

"Breeding is a gamble unless we make more use of progeny records in pedigree breeding" said Mr. Kenneth Russell at Selby on 7th May. The occasion was the Open Days of BOCM's Progeny Testing Station at Barlby Farm, when nearly three thousand farmers were present to see for themselves the value of a comparative test of four Friesian bulls standing at the M.M.B.'s A.I. Centre.

Four groups each of fifteen heifers had been sired by "Maulden Gentian Kinsman," "Marstonmoor Endeavour," "Terling Tempest R.M.," and "Ironside Texan" respectively, and all are being tested for a period of 270 days, under identical conditions of feeding and management, for milk yield, butter fat and solids-not-fat.

Of these, the daughters of "Ironside Texan" have put up such a good all-round performance that the bull promises to be a sire of considerably above average merit. The daughters of "Terling Tempest R.M." are also showing useful results, but the progeny from "Marstonmoor Endeavour" and "Maulden Gentian Kinsman" have been relatively disappointing. It has subsequently been announced that these last two bulls have been withdrawn from A.I. service and slaughtered.

The BOCM progeny tests will be continued, first with Shorthorns, followed by Guernseys and then back to Friesians.

BACON AND BEER

Mr. J. A. Worley of Yalding, Kent, is primarily a fruit, hop and arable farmer, but he also keeps pigs on each of his three farms which total 480 acres. The pigs convert straw into muck for the soft fruit, mainly strawberries, and hops, while the gang-mown swards of the apple and cherry orchards and cob-nut plantations provide a succession of short, palatable grazing for the 40 Landrace and 20 Large White sows.

This breeder has found that in his herds, Large Whites produce more piglets per litter than Landrace, but the latter's piglets are bigger and stronger at birth, so that there is little difference between the litter weights of the two breeds at weaning.

In present circumstances, Mr. Worley finds that one of the greatest handicaps to efficient pig farming is the difficulty of finding capital to equip a farm with modern housing. His own solution to this problem is to make full use of existing buildings to house his pigs.

Having installed hop-picking machines on his farms, Mr. Worley has converted the long rows of redundant hop-pickers' huts into pig pens by raising the floor and installing drinking bowls. Some huts have been pulled down and their corrugated metal walls used to line other huts; straw is packed in between the two skins for insulation.

Pig Farming, May 1957

WORK STUDY IS COMMON SENSE

It is probably true to say that there is no farmer in the country, however large, however small, however efficient, who cannot either add to his income or cut his costs, or both, with a little objective self-analysis.

A case in point is a farm of 50 acres, specializing in egg production. Some

3,500 birds are kept on open range, in 16 pens of two acres each; two men are employed, averaging 49½ hours a week. On the surface, management seems efficient. But closer investigation shows that in the course of their work the men walk 3,000 miles a year; and that in the job of feeding and egg collecting they receive two weeks' wages merely for opening and closing gates.

Only minor alterations were needed in this case to achieve major economies in time and effort. Under a longer-term plan, it became a business proposition to renew and resite the houses, so that stock numbers could be increased by 20 per cent and egg yield by 10 per cent.

Even our best farmers are handicapped by the environment they have inherited, and are to some degree still servants to the new techniques and new tools they have acquired.

Financial Times

BBC TELEVISION FOR FARMERS

The BBC's new agricultural television service is planned to begin in October. The programme will be broadcast weekly on Thursdays, probably from 12.30 p.m. to 1 p.m. over the whole television network of the Corporation. The programmes will be organized from Birmingham, where there are studio facilities, and the Agricultural Unit will be based there under Controller, Midland Region. A producer will be appointed at once to have charge of the programme under the general direction of the BBC's Agricultural Liaison Officer, Mr. H. C. Hunt.

The new programmes will include some 10 minutes of film in addition to news and market reports. Outside broadcasts, because of their complexity and expense, may be confined to the more important events. The use of the camera in market reporting may make possible for the first time the inclusion of store prices. Demonstrations will come from studios.

Television is an ideal medium for the promotion of technical efficiency in farming, and especially for "seeing over the other chap's hedge". Items of research, too, can be quickly put over to farmers in a readily comprehensible way.

The BBC hopes to bring farmers in touch with overseas activities such as pig production in Denmark, wool production in Australia, and horticulture in Holland; also to have full co-operation from overseas agricultural departments such as the U.S. Department of Agriculture, the National Association of Television and Radio Farm Directors in North America, and the recently formed European Farm Television and Radio Association.

The BBC will make film available for overseas television services so that British Agriculture—particularly machinery and livestock—can be seen immediately by farmers throughout the world.

WOMEN IN DANISH AGRICULTURE

To the casual visitor to Denmark, the importance of the role played by women in agriculture is far from obvious, for it is possible to travel across the country without even seeing a female worker on the land. In fact, there are about 51,000 women engaged in farm work, but their duties lie mainly indoors, and sometimes include household tasks. Their contribution is considered vital to the success of the industry, and one of the problems confronting Danish agriculture today is how to retain these women workers in face of the attractions of urban life and employment, particularly the better housing.

Scottish Agriculture, Spring, 1957

Book Reviews

Bright Boots. FRED GRESSWELL. Hale. 18*s*.

This is a success story, modestly and agreeably told. Mr. Gresswell found no difficulty in retiring in comfort from his successful property business in middle age. But his youth was one of poverty. He was born in the 1890s in the Lincolnshire village of Digby, where his father was a farm labourer, and his early memories recall a form of rural society which is now remote from us. For this was the countryside of Arch and Haggard, where a monocled squire led a procession of servants to church every Sunday, headed by the butler and the housekeeper, where pigs and sermons were the main interests of the villagers, the local carpenter charmed away warts and the workhouse waited to receive men in their old age. It was a harsh, limited world, redeemed by good humour and the power of habitual acceptance, and it preserved many of the traditions of an extinct peasantry. Indeed, Mr. Gresswell's mother was—and fortunately still is—a survivor from an older, simpler, tougher England, a living exemplar of the peasant virtues of frugality, tenacity, independence and tireless application to the matter in hand.

She needed all these qualities, for she had two ambitions—to raise her husband to the status of a farmer (even if a small one) and to see her sons in jobs where they could wear clean boots. In spite of difficulties, both objects were achieved. One son, it is true, became a farmer, with his own mud on his boots. Another became a senior civil servant, another a haulier, another a carpenter. She herself still lives in the village, and a photograph shows her smilingly milking a cow and looking about 70 at the age of 98!

Much of the book deals with the author's business career, and the last section gives an enjoyable personal anthology of quotations. Among them, typically, are many sayings of Benjamin Franklin, including, less typically, his wise (but deplorable) " Letter to a Young Man ". But to the austerely rural reader perhaps the most interesting part of the book is the comparison of Digby in the 1890s with Digby in the 1950s. The estates have gone, the " big houses " are empty, the village trades of tailor, saddler, blacksmith and bootmaker have disappeared, and only a handful of people now attend the church and chapel. But the old isolation, ignorance and poverty have gone. Mr. Gresswell knows the past too well to sentimentalize over it. He contents himself with recording it vividly and sensibly.

N.H.

Living from the Land: A Guide to Farm Management. FRANK SYKES. Geoffrey Bles. 21*s*.

In his introduction, the author declares: " This is a book on farm management—as I know it. It is a subject of great importance to the whole economy of this country." However, the author's concept of the term " farm management " is much wider than that held by other modern writers, especially economists. Farm management, to him, is the process of successful farming, involving the application of modern techniques and scientific discoveries in such a way that the farmer derives the maximum benefit through higher productivity and larger profits. In describing the means to this end there are chapters on the ley, animal breeding, the dairy, pigs and poultry, and farm buildings, which contain brief but lucid accounts of the present extent of our knowledge in each of these subjects.

In the chapter " Power and Work Load ", Mr. Sykes advocates forward planning in order to crop and stock a farm efficiently. His objective is stated thus: " The ideal labour load on a farm is one which gives each man full employment on a job which will allow his employer an adequate return for every working day in the year ". Although this ideal can hardly be achieved on any farm, it is, nevertheless, good farm management to plan as near to the ideal as possible, and in a later chapter on tractors, implements and machinery, a method is described of preparing labour requirements and schedules. In this way it is possible to foresee troughs and peaks in labour needs and to devise schemes for their correction by judicious mechanization and proper timing of operations.

The author acknowledges the great benefits that have accrued from the efforts of scientists and agricultural research workers, but does not always agree with the interpretation of results of experiments and the application of scientific findings to farming practice. He disapproves of the grazing of winter cereals and the early tedding of hay, but deplores the delay in the application of the science of genetics to animal breeding. He is outspoken in his condemnation of the forces and interests which hamper progress in this field, pointing out that it is no longer true that "like breeds like" but rather "handsome is as handsome does".

This book is based on the observations of a highly successful farmer who has had unique experiences as an agricultural consultant. In the latter capacity the author has gained first-hand knowledge of a wide range of farming systems under a variety of conditions. Although the book is written in the language of the modern large-scale farmer, frequent references are made to the special problems of the small farmer, who is proffered sound and sympathetic advice without being encouraged to expect too much comfort.

W.E.J.

Proceedings of Conference "Agriculture in the British Economy". Imperial Chemical Industries. 21*s*.

Economic changes and scientific advances come so quickly to farming that there is rarely opportunity to sit back and try to appraise what agriculture has done, what it is doing now and what part it is likely to play in the future economy of the country. Such an opportunity came at Brighton last November when I.C.I. organized a conference on "Agriculture in the British Economy". Very careful preparation and efficient but unobtrusive management made this conference an outstanding success. Its deliberations were summarized in the January issue of AGRICULTURE. Now the Proceedings, edited by Sir James Scott Watson, have been published in a book which, though very reasonable in price, attains to the high level of the conference itself. The Proceedings record every word spoken in the sessions, except for the closing recapitulations which are omitted to avoid repetition. To those fortunate enough to attend the conference, this permanent record gives the chance to ruminate on all the wisdom they heard; for those who were not there, it provides great interest and much information; for those who come after, it will be a record of informed opinion in 1956. Its publication is an event of great agricultural importance and, indeed, of considerable national significance.

H.G.S.

The Dairy Farmer's Veterinary Book (2nd Edition). N. BARRON. Dairy Farmer Books. 21*s*.

The avowed object of this revised and enlarged edition of *The Dairy Farmer's Veterinary Book*, first published in 1950, is to ensure freedom from illness and better health for our cattle by inculcating a greater understanding of the factors responsible for causing diseases.

The eighteen chapters cover the causes and treatment of common diseases of the dairy cow, and also deal with calving, calf ailments, reproduction, first-aid and bull management. The test is illustrated by many excellent photographs and explanatory diagrams on the "how it is done" principle, and there are two charts —one depicting the regional anatomy of the cow, and the other as a handy aid to diagnosis.

Even if current veterinary information makes the book's motive rather idealistic, it is still salutary to keep reviewing the position, find out where we stand, and teach an appreciation of the facts and limitations of knowledge relating to animal diseases. This the book does admirably.

The changing pattern of animal diseases and the labours of research workers do not make the author's task easier, and it is probably incorrect nowadays to say, as the author does, that most mastitis cases are caused by *Streptococcus agalactiae*. Udder-clap, garget, summer bag and gangrenous mastitis are all very common and, as yet, there is no very satisfactory means of control. I liked the generous instructions for drenching a cow: here the cowman is advised to have an assistant to steady the head. Unfortunately, on many farms today, this operation, perforce, has to be carried out single-handed.

Since sick animals cannot easily queue at the surgery door, it is really desirable that people in charge of cattle should be instructed as well as intelligent. Tradition and hearsay are definitely not enough. The job continually calls for observation, action and sound decisions, and it is here that Dr. Barron's book will be distinctly helpful.

W.L.S.

The Numbers of Man and Animals. (A Record of the Symposium held in September 1954 by the Institute of Biology). J. B. CRAGG and N. W. PIRIE. Oliver and Boyd. 15*s*.

This *ensemble* of authoritative essays will have little appeal to the "average" farmer or to the general agricultural scientist. But for the serious student of socio-economics or animal ecology it is an invaluable work of reference and a stimulus to broader vision in the management of organic nature. Since crises in world affairs often arise from some form of population pressure, the book might also be read with profit by those who control the destiny of nations. Exhaustion of natural resources by an expanding world population is shrewdly discussed by Lord Boyd Orr, who states that "the physicists and chemists can give power to governments but biologists can provide wisdom ".

Professor Penrose argues ingeniously against the view, expressed by K. Pearson in 1912, that the population is "silently rotting at the core", and despite the more recent dictum of G. Thompson in 1949 that "the level of intelligence is really sinking". Human fertility, changing sex-ratios, and posthumous paternity (through semen preservation) are ably dealt with by Dr. Parkes, and Dr. Hammond views the level of nutrition in late pregnancy as a major factor affecting population-increase in mammals. Modern insecticides and chemotherapeutics are likely to "unbalance the whole biological, economic and social structure of large areas of the world", according to Professor Banks; and Dr. Darling regards commercial pastoralism as an insidious means of exploiting the natural wealth of vegetation, resulting in lowered fertility rates of the animals and dereliction of the area.

Dr. Chitty contends that the physiological condition of the individual varies with population density, and his experiments on voles indicate that such changes are "caused by interactions between animals living in close contact".

Other contributors deal with the factors limiting population-growth, but there is diversity of opinion regarding those which operate *critically* in nature, and new unifying themes in the behaviour of men and other animals have not emerged from this survey. I conclude with Dr. Chitty's delightful epitome of fate (p. 59): ". . . causes of death in human beings are so numerous that however many hazards are avoided one will eventually prove fatal"!

D.S.MacL.

Annual Farming Digest and Agricultural Directory of Scotland, 1957. Edited by WILLIAM MACDONALD. Mearns Agricultural Publications. 10*s*. 6*d*.

" War, navigation and commerce can never dispeople a wise nation whose agriculture flourishes in full vigour." Such is the quotation by Canon Harte on the title page of the 1957 edition of the *Annual Farming Digest and Agricultural Directory of Scotland*.

This useful digest of farming facts and figures, now in its third year, carries some 360 pages of information and guidance of value to everyone interested in the land.

Following a foreword by the Earl of Airlie, the " leading article " deals with Scottish farm mechanization and states, among other things, that for every two tractors placed on the land in Scotland five horses march off it. There are other articles on such varied subjects as combine harvesting, hammer mills and soil fertility.

The directory also contains a 24-page illustrated guide to the area of this year's Royal Highland Show to be held at Dundee June 18–21.

In addition to outlining the origins and developments of the various breeds of cattle, horses, ponies, sheep and pigs, the directory provides a well-illustrated list of breed show points.

There is an extensive buyers' guide and the well-indexed reference section provides a wealth of agricultural and other information.

G.C.

Profits and Problems of Farming in South-East England. J. D. SYKES and G. P. WIBBERLEY. Department of Agricultural Economics, Wye College. 7*s.* 6*d.*

It comes as something of a shock, on reading this stimulating and well-reasoned report, to learn that the "Garden of England" is really one of the most agriculturally backward areas in England and Wales. For instance, in seven of the ten years since 1944–45, dairy farmers in the south-east (Kent, Surrey and Sussex) earned profits averaging less than half those earned on similar farms elsewhere in England and Wales. "On occasions," says the report, "farm incomes have fallen well below the level on poor upland farms in Wales".

Taking an identical sample of 150 farms for the three years 1952–53 to 1954–55, the authors probe for an explanation. In a careful step-by-step analysis of the economic circumstances of these farms, the authors isolate the possible causes. The consumption of fertilizers was low, and was even declining, whilst the purchases of feedingstuffs was increasing. Tenants' capital was not so much inadequate as badly distributed, too much of it on the small farms being tied up in machinery. Yields from crops and stock were low. But the fundamental cause was bad management in the feed economy. "This is the crux of the matter," says the report, "farmers either do not have the ability or do not care to involve themselves in the harder task of better grassland management". It is both a severe indictment and a challenge.

In their concluding chapter the authors anticipate the question forming in the reader's mind. "If profits are so low how do the farmers survive at all, and why do they not seek more remunerative employment elsewhere?" They find an answer to the first part of the question in the farmer's ability to live off his farm, and the difficulty of satisfactorily accounting for all the non-cash benefits; their answer to the second is simply that the farmer is not always an "economic man".

But there is another question which they leave unanswered. "Why should not the farmers of the south-east, with all their advantages of location and climate, be at the top of the agricultural ladder rather than at the bottom?" Perhaps this is a sociological rather than an economic problem, but it is a little unkind of the authors to arouse our curiosity so successfully and then leave it unrequited.

This is an important and imaginative report which should certainly be read by all those who are concerned to improve the efficiency of British agriculture. Copies are obtainable from the Department of Agricultural Economics, Wye College, near Ashford, Kent.

B.E.C.

The Agricultural History Review (Vol. V, Part 1, 1957). British Agricultural History Society. 12*s.* 6*d.*

The latest issue of this *Review* continues both the pattern and the standard of its predecessors. Its sixty pages contain four major articles, notes and correspondence, and an invaluable bibliography of recent publications on agrarian history.

The articles illustrate strikingly the scope of the modern agricultural historian. Dr. Franks discusses pollen analysis as a means of investigating the remoter past; Mr. Gray explains the peculiar development and survival of the Highland crofting system; Dr. Chaloner gives an account of the agricultural activities of Wilkinson the ironmaster and reminds us that industrial capital is no new factor in our rural economy; and Dr. Allison describes the sheep-and-corn system of late medieval and Tudor Norfolk and the manner in which it was transformed into the "Norfolk husbandry" of the agricultural revolution. Incidentally, he shows that Townshend and Coke were the paradoxical heirs of landlords who strove to restrict the cultivation of turnips because it interfered with their right of running sheep at certain times over the open fields.

All this is more than interesting. It is also more than tantalizing. Here are samples of the mass of material that is now becoming available in book, article and thesis. But where is the authoritative history of British farming incorporating all this new learning for which we have been waiting so long? Fortunately the *Review* can give a reassuring answer to the question which its contents raise. The scheme for an agrarian history of England, first announced a year ago, is now developing with the aid of a generous grant from the Nuffield Foundation, and plans for the first volume are already being prepared.

N.H.

The Friendly Fungi. C. L. DUDDINGTON. Faber. 21*s*.

Truth is sometimes stranger than fiction, and many people may find it difficult to believe that there are fungi in the soil capable of capturing and feeding on eelworms. The first predacious fungus was recognized in 1888, but it was nearly fifty years later before further species with this interesting habit were discovered. Dr. Duddington is an acknowledged expert and has done much to increase our knowledge of these fungi. In this book four chapters are devoted to them exclusively.

Many species of predacious fungi can live in two entirely different ways—either as saprophytes, feeding on decaying organic matter, or as predators, feeding on eelworms. Others, which do not lead a separate existence in the soil, and can grow only inside the bodies of eelworms, are perhaps better called parasites. The vivid descriptions of the different ways in which eelworms are caught, and the excellent photographs, cannot fail to conjure up some slight pity for the eelworms, although as far as the plant-parasitic eelworms are concerned this may be a transient emotion.

The last part of the book deals with attempts made in Hawaii before the war, and more recently in France and Great Britain, to use these fungi for the control of eelworms. The results have been promising, but the author is the first to acknowledge that there are still many questions to be answered and much work to be done before their use can be recommended.

It seems strange in a book on fungi to find two chapters on plant-parasitic eelworms, and it is immediately apparent that the author is on unfamiliar ground here—a fact which he freely admits in the preface. An exaggerated idea is given of the losses caused by eelworms in such statements as, "Much of our best potato land is potato sick and virtually useless" and "The Beet Eelworm is destroying sugar beet on a grand scale". An oversimplified account is given of the routine examination of soil samples for Potato Root eelworm carried out by the N.A.A.S.: it is implied that counts of total cysts only are made, whereas in fact most provinces examine cysts for viability, and a few do egg and larval counts. A number of other errors and misconceptions, too numerous to mention here, are present, but these may be excused in a book dealing primarily with fungi.

In the appendices, hints are given on the collection, cultivation and examination of predacious fungi; there are instructions for the trained biologist, and the author shows ways in which the keen amateur, provided he has a fairly good microscope, can obtain considerable enjoyment.

Unfortunately, there are no common names for the fungi, and it is hoped that the general reader will not be put off by the many scientific designations. If he regards the section on eelworms as a background, he will find the book well worth reading and an excellent summary of present knowledge. For the farmer, however, it is more of academic interest than of practical value, since it will probably be many years before we are able to harness these fungi for the benefit of agriculture.

E.B.B.

The Measurement of Surface Friction of Grain to Determine its Moisture Content. P. FINN-KELCEY and P. E. CLAYTON. Electrical Research Association. 15*s*. (15*s*. 6*d*. by post).

There are already fifty or more rapid moisture testers available on the world market, of which eight are in common use in agriculture in this country, the methods of operation of which can be reduced to about eight basic principles. The meters based on these principles each have certain advantages and disadvantages such as the time taken to obtain a reading, the size of sample required, whether or not the sample has to be milled, the complication involved in obtaining a result, and the cost. Many of these features are in conflict; for example, it is difficult to devise a rapid tester which does not involve separate calibration charts for individual materials. The extent to which any one tester can be said to be better than others depends a great deal, therefore, on the circumstances in which it is to be used. No single meter can be said to be better than all the others in all conditions, and there is still scope for designing an instrument which approaches this ideal more closely.

The E.R.A. report describes an attempt to develop a moisture tester working on a basis which is thought not to have been tried before, namely, to assess the moisture content of a sample by recording, in arbitrary units, the frictional effect of the

sample on a probe forced into it. The considerations which caused this particular principle to be adopted are listed, and the experimental work which led to the present prototype design is described. Calibration curves are given for the final instrument with wheat, barley and oats.

This moisture tester appears to suffer from disadvantages similar to those in many existing meters, in that it is influenced by surface dryness or wetness, contamination of the grain by straw, weed seeds, unthreshed heads, and by an abnormal proportion of small grains. The size of sample required is inconveniently large for many purposes. There are the possible advantages of being completely self-contained and avoiding the need for milling the sample, but these advantages are not peculiar to this instrument and the milling requirement serves a purpose with some testers in reducing the influence of surface wetness or dryness of the grain.

M.G.R.W.

Proceedings of the Rubber in Engineering Conference. The Natural Rubber Development Board.

The Proceedings of the Rubber in Engineering Conference held at the Institution of Electrical Engineers in September 1956, have now been published in book form. The paper of most interest to farmers was Mr. S. J. Wright's "Rubber in Agriculture", and an account of some of the points discussed by Mr. Wright was given in Mr. H. J. Hine's article "The Uses of Rubber in Agriculture" in the December 1956 issue of AGRICULTURE.

Copies of the proceedings may be obtained free from the Natural Rubber Development Board, Market Buildings, Mark Lane, London, E.C.3.

Books Received

Farm Mechanization Handbook (3rd Edition). T. Hammond Cradock. Temple Press. 25*s.*

Watching Birds. James Fisher. Collins. 8*s.* 6*d.*

John Innes Horticultural Institution Forty-Seventh Annual Report, 1956. 3*s.*

Orchids: Culture and Descriptions. Marcel Lecoufle and Henri Rose. Crosby Lockwood. 17*s.*

Rural Depopulation in England and Wales, 1851–1951. John Saville. Routledge and Kegan Paul. 28*s.*

Handbook for Vegetable Growers. J. E. Knott. Chapman and Hall. 32*s.*

An Economic Study of Pig Production in South West England 1955–56. (Report No. 99). Estelle Burnside and R. C. Rickard. Department of Economics, University of Bristol. 2*s.* 6*d.*

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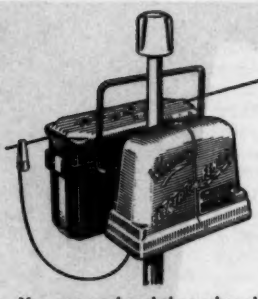

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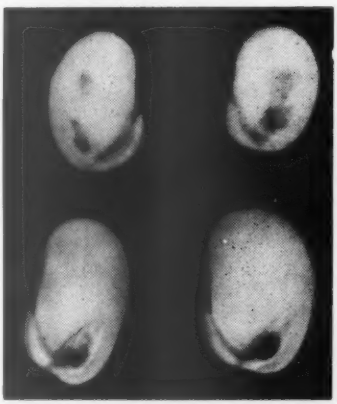

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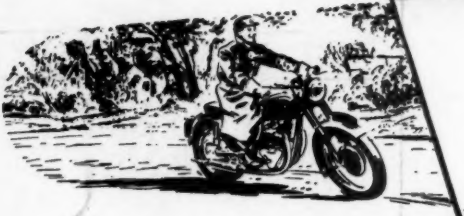
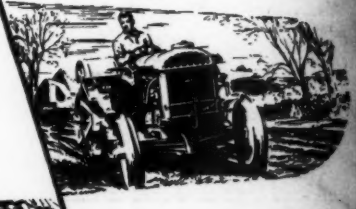
14J NEW BURLINGTON STREET LONDON W.1
Telephone REGent 1921 (five lines) — Cables CHEMICARBO LONDON

Whatever you own



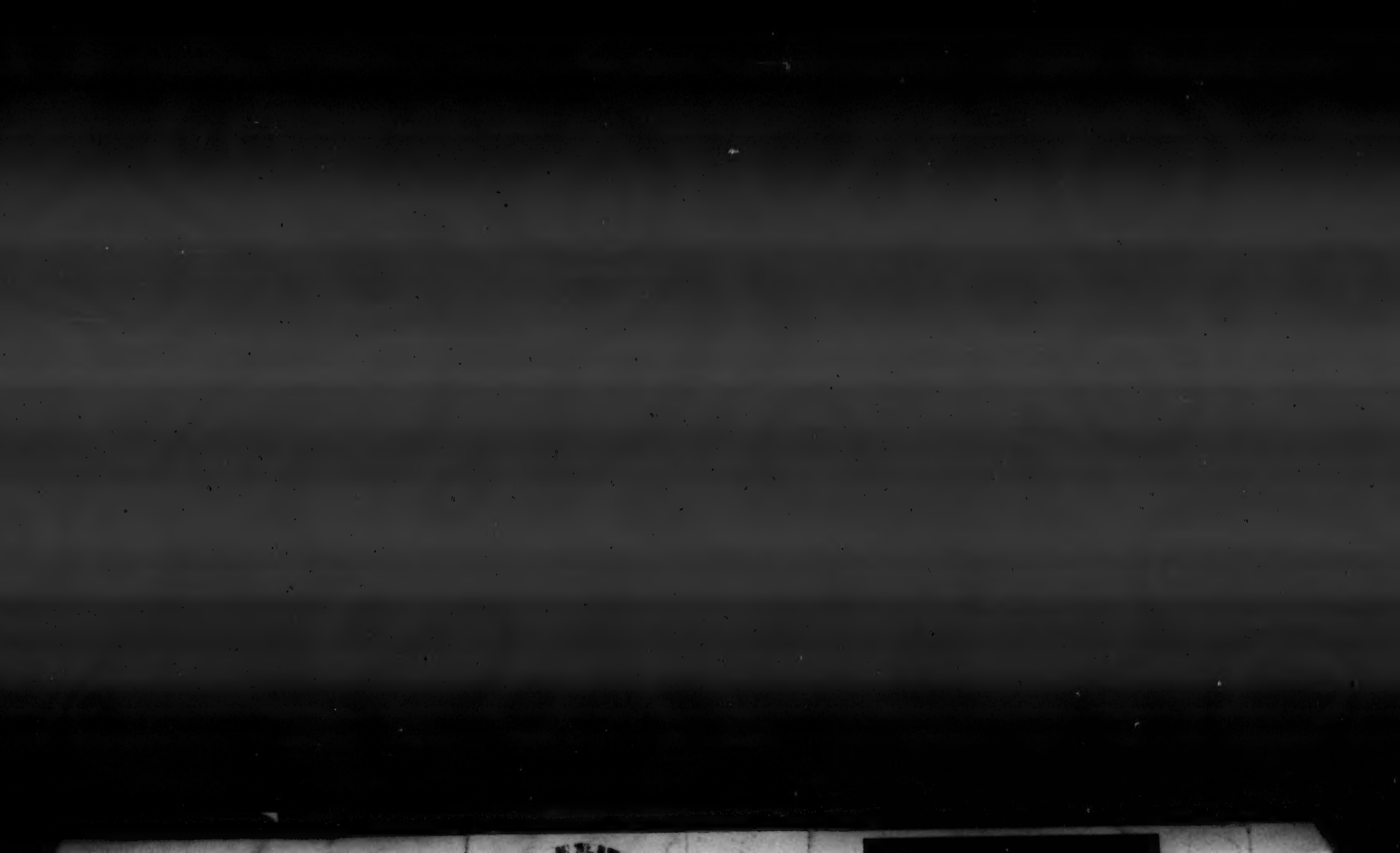
...no waiting

for electrical repairs



For most vehicles after 1936 you can obtain a Factory reconditioned replacement Magneto, Distributor, Starter, Dynamo or other electrical unit immediately. It prevents that idle waiting period while a repair is undertaken.

** See your nearest garage or LUCAS agent for details*

LUCAS
B 90
IMMEDIATE EXCHANGE SERVICE

JOSEPH LUCAS LTD • BIRMINGHAM 19